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H3SC
1953

CONSTRUCTION & OFFICE
STANDARDS

STATE HIGHWAY COMMISSION
OF MONTANA

57 Morris Griffith

HELENA, MONTANA

REVISED 9-1-1953

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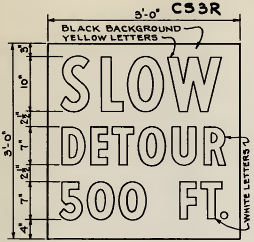
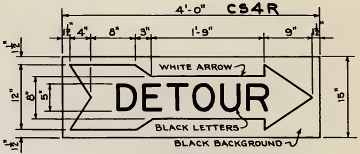
REFLECTORIZED CONSTRUCTION SIGNS

CS 1,2,3&4(R)



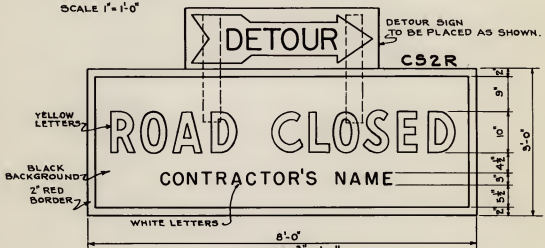
SCALE 1" = 1'-0"



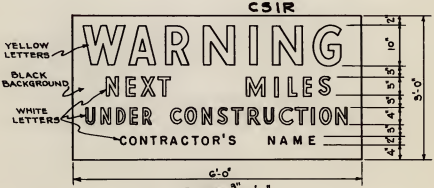
ARROW FOR DETOUR RIGHT

USE WITH REVERSE ARROW FOR DETOUR LEFT.

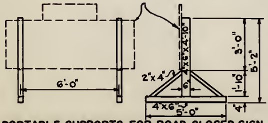
SCALE 1" = 1'-0"



SCALE ¾" = 1'-0"



SCALE ¾" = 1'-0"



PORTABLE SUPPORTS FOR ROAD CLOSED SIGN

SCALE 1/4" = 1'-0"

NOTE:- SIGNS TO BE FURNISHED AND ERECTED BY THE CONTRACTOR. SIGNS TO BE CONSTRUCTED OF 3/4" WATERPROOF PLYWOOD OR OTHER MATERIAL THAT WILL SATISFACTORILY WITHSTAND THE WEATHER. EITHER THE BACKGROUND OR LETTERS SHALL BE REFLECTORIZED (WIDE ANGLE). SIGNS TO BE FASTENED SECURELY TO 4"x4" POSTS SET AT LEAST 3'-0" IN THE GROUND AND TAMPED. CENTER OF SIGN TO BE 3.5' ABOVE GROUND. THE ROAD CLOSED SIGN MAY, AT THE CONTRACTORS OPTION, BE FASTENED TO 4"x4" POSTS AS SPECIFIED ABOVE OR MOUNTED ON THE PORTABLE SUPPORTS AS DETAILED AT LEFT. SUPPORTS TO BE SECURELY ANCHORED OR WEIGHTED DOWN.

THE LOCATION TO BE DETERMINED BY THE ENG'R.

APPROVED - JAN. 1, 55

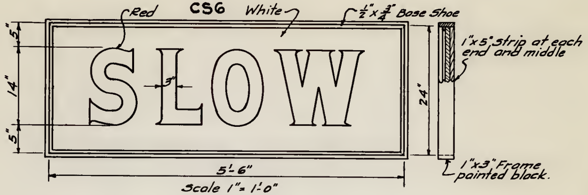
V. C. [illegible]

CONTROL ENGINEER

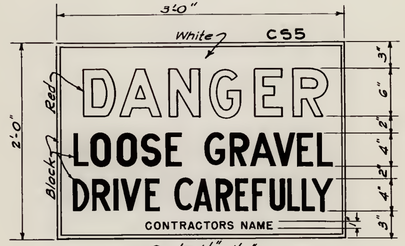
Montana State Highway Commission.

REFLECTORIZED CONSTRUCTION SIGNS

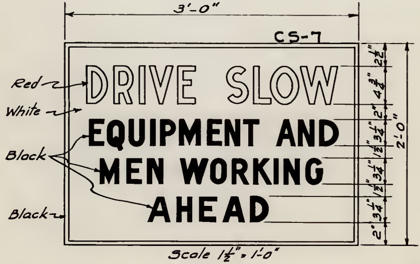
CS-5,6 & 7


Red
CS6
White
$\frac{1}{2}$"x$\frac{3}{4}$" Base Shoe
1"x5" strip at each end and middle
SLOW
5"
14"
5"
3"
24"
5'-6"
1"x3" Frame painted black.

Scale 1" = 1'-0"



Scale $1\frac{1}{2}$" = 1'-0"



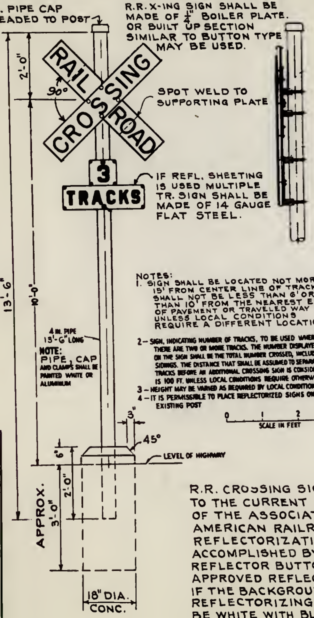
Scale $1\frac{1}{2}$" = 1'-0"

NOTE :- SIGNS TO BE FURNISHED AND ERECTED BY THE CONTRACTOR. SIGNS TO BE CONSTRUCTED OF $\frac{3}{4}$" WATERPROOF PLYWOOD OR OTHER MATERIAL THAT WILL SATISFACTORILY WITHSTAND THE WEATHER. EITHER THE BACKGROUND OR LETTERS SHALL BE REFLECTORIZED (WIDE ANGLE). SIGNS TO BE FASTENED SECURELY TO 4"x4" POSTS SET AT LEAST 3'-0" IN THE GROUND AND TAMPED. CENTER OF SIGN TO BE 3.5' ABOVE GROUND. THE LOCATIONS TO BE DETERMINED BY THE ENGINEER.

APPROVED - JAN. 1, 53
CONTROL ENGINEER
REV. 10-1-51

Montana State Highway Commission

90° REFLECTORIZED R.R. CROSSING PROTECTIVE SIGN


STD. PIPE CAP THREADED TO POST
IF REFL. SHEETING IS USED R.R. X-ING SIGN SHALL BE MADE OF 1/4" BOILER PLATE. OR BUILT UP SECTION SIMILAR TO BUTTON TYPE MAY BE USED.
RAIL
ROAD
CROSSING
90°
2'-0"
13'-6"
10'-0"
SPOT WELD TO SUPPORTING PLATE
3
TRACKS
IF REFL. SHEETING IS USED MULTIPLE TR. SIGN SHALL BE MADE OF 14 GAUGE FLAT STEEL.
4 IN. PIPE 13'-6" LONG
NOTE: PIPE, CAP AND CLAMPS SHALL BE PAINTED WHITE OR ALUMINUM
3"
45°
6"
LEVEL OF HIGHWAY
2'-0"
APPROX. 3'-0"
18" DIA. CONC.

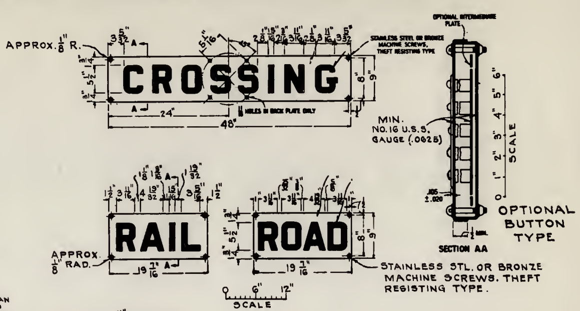
NOTES:
1. SIGN SHALL BE LOCATED NOT MORE THAN 15' FROM CENTER LINE OF TRACK AND SHALL NOT BE LESS THAN 6' OR MORE THAN 10' FROM THE NEAREST EDGE OF PAVEMENT OR TRAVELED WAY UNLESS LOCAL CONDITIONS REQUIRE A DIFFERENT LOCATION.

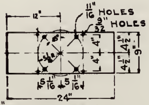
2 – SIGN, INDICATING NUMBER OF TRACKS, TO BE USED WHERE THERE ARE TWO OR MORE TRACKS. THE NUMBER DISPLAYED ON THE SIGN SHALL BE THE TOTAL NUMBER CROSSED, INCLUDING SIDINGS. THE DISTANCE THAT SHALL BE ASSUMED TO SEPARATE TRACKS BEFORE AN ADDITIONAL CROSSING SIGN IS CONSIDERED IS 100 FT. UNLESS LOCAL CONDITIONS REQUIRE OTHERWISE.

3 – HEIGHT MAY BE VARIED AS REQUIRED BY LOCAL CONDITIONS.

4 – IT IS PERMISSIBLE TO PLACE REFLECTORIZED SIGNS ON EXISTING POST

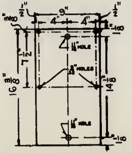
0 1 2 3
SCALE IN FEET


APPROX. 1/8" R.
3 5/32"
A
CROSSING
24"
48"
8"
9"
1/16" HOLES IN BACK PLATE ONLY
STAINLESS STEEL OR BRONZE MACHINE SCREWS, THEFT RESISTING TYPE
OPTIONAL INTERMEDIATE PLATE
MIN. NO. 16 U.S.S. GAUGE (.0625)
.105 ±.020
SECTION AA
0 1" 2" 3" 4" 5" 6" SCALE
OPTIONAL BUTTON TYPE
RAIL
ROAD
APPROX. 1/8" RAD.
19 7/16"
STAINLESS STL. OR BRONZE MACHINE SCREWS. THEFT RESISTING TYPE.
0 6" 12"
SCALE

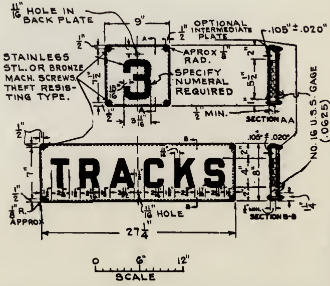


1/4" SUPPORTING PLATE

6 12
SCALE



1/4" SUPPORTING PLATE



R.R. CROSSING SIGN TO CONFORM TO THE CURRENT SPECIFICATIONS OF THE ASSOCIATION OF AMERICAN RAILROADS.
REFLECTORIZATION MAY BE ACCOMPLISHED BY MEANS OF REFLECTOR BUTTONS OR APPROVED REFLECTORIZING SHEETING IF THE BACKGROUND CONSISTS OF REFLECTORIZING SHEETING IT SHALL BE WHITE WITH BLACK LETTERS.

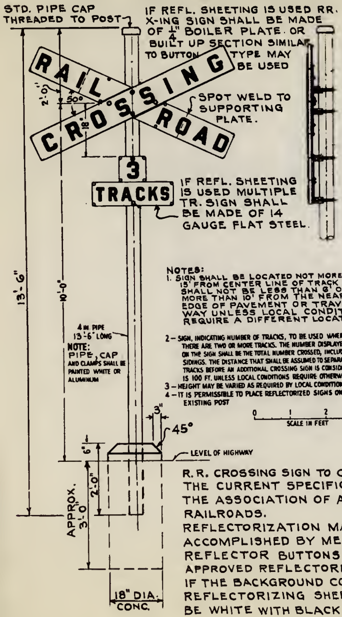
APPROVED - JAN. 1, 53
CONTROL ENGINEER
REV. 10-1-51

RCS-3

3

Montana State Highway Commission.

50° REFLECTORIZED R.R. CROSSING PROTECTIVE SIGN


STD. PIPE CAP THREADED TO POST
IF REFL. SHEETING IS USED RR. X-ING SIGN SHALL BE MADE OF 1/4" BOILER PLATE OR BUILT UP SECTION SIMILAR TO BUTTON TYPE MAY BE USED
RAIL ROAD
CROSSING
SPOT WELD TO SUPPORTING PLATE.
2'-0"
50°
18"
3
TRACKS
IF REFL. SHEETING IS USED MULTIPLE TR. SIGN SHALL BE MADE OF 14 GAUGE FLAT STEEL.
13'-6"
10'-0"
4 IN. PIPE 13'-6" LONG
NOTE: PIPE, CAP AND CLAMPS SHALL BE PAINTED WHITE OR ALUMINUM
3"
45°
6"
LEVEL OF HIGHWAY
2'-0"
APPROX. 3'-0"
18" DIA. CONC.

NOTES:

1. SIGN SHALL BE LOCATED NOT MORE THAN 15' FROM CENTER LINE OF TRACK AND SHALL NOT BE LESS THAN 6' OR MORE THAN 10' FROM THE NEAREST EDGE OF PAVEMENT OR TRAVELED WAY UNLESS LOCAL CONDITIONS REQUIRE A DIFFERENT LOCATION.

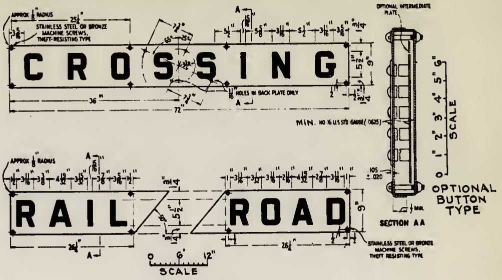
2 – SIGN, INDICATING NUMBER OF TRACKS, TO BE USED WHERE THERE ARE TWO OR MORE TRACKS. THE NUMBER DISPLAYED ON THE SIGN SHALL BE THE TOTAL NUMBER CROSSED, INCLUDING SIDINGS. THE DISTANCE THAT SHALL BE ASSUMED TO SEPARATE TRACKS BEFORE AN ADDITIONAL CROSSING SIGN IS CONSIDERED IS 100 FT. UNLESS LOCAL CONDITIONS REQUIRE OTHERWISE.

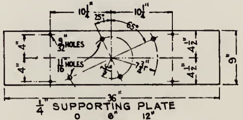
3 – HEIGHT MAY BE VARIED AS REQUIRED BY LOCAL CONDITIONS.

4 – IT IS PERMISSIBLE TO PLACE REFLECTORIZED SIGNS ON EXISTING POST

0 1 2 3
SCALE IN FEET

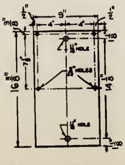
R. R. CROSSING SIGN TO CONFORM TO THE CURRENT SPECIFICATIONS OF THE ASSOCIATION OF AMERICAN RAILROADS.
REFLECTORIZATION MAY BE ACCOMPLISHED BY MEANS OF REFLECTOR BUTTONS OR APPROVED REFLECTORIZING SHEETING.
IF THE BACKGROUND CONSISTS OF REFLECTORIZING SHEETING IT SHALL BE WHITE WITH BLACK LETTERS.


APPROX. 1/8" RADIUS
25 1/4"
STAINLESS STEEL OR BRONZE MACHINE SCREWS, THEFT-RESISTING TYPE
A
CROSSING
65°
25°
11/16" HOLES IN BACK PLATE ONLY
36"
72"
MIN. NO 16 U.S. STD GAUGE (.0625)
9"
OPTIONAL INTERMEDIATE PLATE
SCALE
0 1" 2" 3" 4" 5" 6"
RAIL
ROAD
26 1/4"
.105 ±.020
SECTION AA
OPTIONAL BUTTON TYPE
STAINLESS STEEL OR BRONZE MACHINE SCREWS, THEFT RESISTING TYPE
0 6" 12"
SCALE

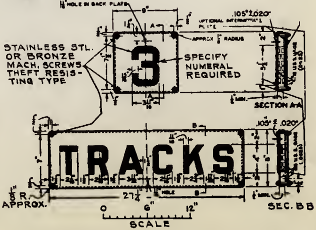


1/4" SUPPORTING PLATE

0 6" 12"
SCALE



1/4" SUPPORTING PLATE

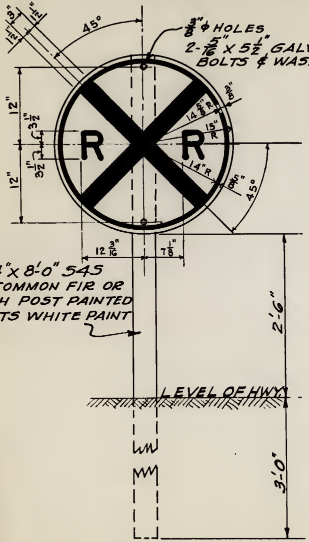


APPROVED - JAN. 1, 53
CONTROL ENGINEER
REV. 10-1-51

RCS-2

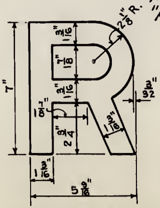
4

REFLECTORIZED R.R. ADVANCE WARNING SIGN


45°
3/8" φ HOLES
2-5/16" X 5 1/2" GALV. BOLTS & WASHERS.
1 1/2"
3"
1 1/2"
12"
3 1/2"
1"/32
12"
R
R
14 5/8" R.
15" R
14" R
3/8"
3/8"
45°
12 3/16"
7/8"
4"x4"x 8'-0" S4S NO. 1 COMMON FIR OR LARCH POST PAINTED 3 COATS WHITE PAINT
2'-6"
LEVEL OF HWY.
3'-0"

R.R. ADVANCE WARNING SIGN SHALL BE MADE OF 16 GAUGE SHEET STEEL & SHALL HAVE EITHER A SYNTHETIC ENAMEL OR VITREOUS ENAMEL FINISH.

R.R. ADVANCE WARNING SIGN SHALL BE PLACED NOT LESS THAN 6' NOR MORE THAN 10' FROM THE EDGE OF PAVEMENT OR TRAVELED WAY, UNLESS LOCAL CONDITIONS REQUIRE A DIFFERENT LOCATION, WITH THE LOWEST EDGE OF SIGN 2 1/2' ABOVE THE ROAD SURFACE & AT A MIN. OF 100' AND A MAX. OF 500' FROM THE X-ING OR AS DIRECTED BY THE ENGINEER.
BACKGROUND - HIGHWAY YELLOW.
BORDER, SYMBOL, AND LETTERING - BLACK.
REFLECTORIZED BY REFLECTOR BUTTONS IN SYMBOL AND LETTERS, OR BY "REFLECTING SHEETING" BACKGROUND.



DETAIL OF LETTER

APPROVED - JAN. 1, 53
CONTROL ENGINEER
REV. 10-1-51

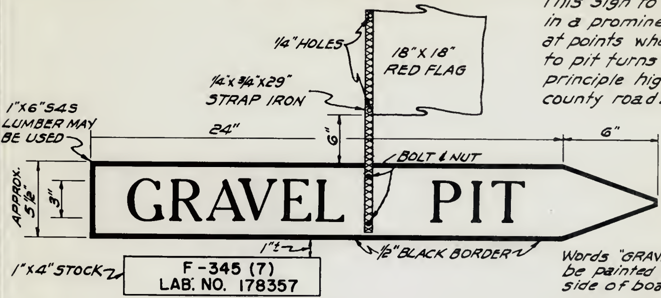
Montana State Highway Commission.

RCS-1

GRAVEL PIT SIGN

6-GPS

This sign to be placed in a prominent position at points where route to pit turns off from principle highway or county road.



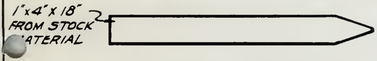
Words "GRAVEL PIT" to be painted on each side of board.

Board to be painted "HIGHWAY RED" with BLACK letters.

This sign to be suspended from 6"x24" sign by any convenient method, noting that it may be used only once. Board need not be painted. Letters 1" high, BLACK. Project number and first of pit laboratory numbers to be used. If a maintenance stockpile, use contract number instead of project number.

This sign to be placed on a gate or fence post, or fastened to a steel post, whichever is most suitable. If to be fastened to fence post a method should be contrived that will not preclude continued use of the sign.

ROUTE MARKER



To be painted "HIGHWAY RED" both sides with 1/2" BLACK border. The route markers should be constructed for reuse.

These markers to be placed along the route from the "GRAVEL PIT" sign to the gravel pit, being so located that route will be clearly defined.

MARKINGS AT PIT

The gravel pit should be marked and signed in accord with any current instructions. In general, the boundary of the pit should be well marked by lath and RED flags. Test holes should be marked by stakes ~ showing depth of overburden and gravel.

APPROVED Aug 20, 1954

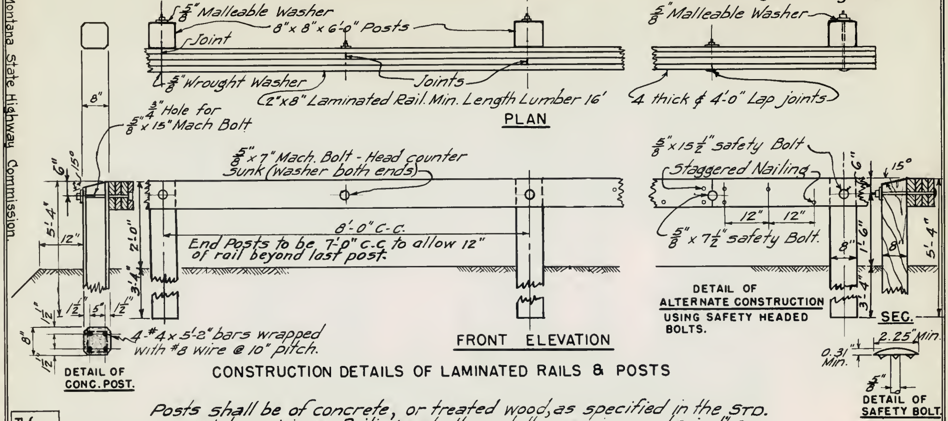
Fred Quinnell Jr.

PRECONSTRUCTION ENGINEER

Montana Highway Commision

Montana State Highway Commission.

LAMINATED WOOD GUARD RAIL


End post shall be offset as directed by the Engineer.
5/8" Malleable Washer
8" x 8" x 6'-0" Posts
Joint
Joints
5/8" Wrought Washer
2"x8" Laminated Rail. Min. Length Lumber 16'
4 thick & 4'-0" Lap joints
PLAN
8"
3/4" Hole for 5/8" x 15" Mach Bolt
5/8" x 7" Mach. Bolt - Head counter sunk (washer both ends)
6"
15°
5'-4"
12"
2'-0"
3'-4"
8'-0" C-C.
End Posts to be 7'-0" c.c to allow 12" of rail beyond last post.
1 1/2"
5"
1 1/2"
8"
4-#4 x 5'-2" bars wrapped with #8 wire @ 10" pitch.
DETAIL OF CONC. POST.
FRONT ELEVATION
5/8" x 15 1/2" safety Bolt
Staggered Nailing
12"
12"
5/8" x 7 1/2" safety Bolt.
8"
1'-6"
3'-4"
DETAIL OF ALTERNATE CONSTRUCTION USING SAFETY HEADED BOLTS.
SEC.
2.25" Min.
0.31" Min.
5/8"
DETAIL OF SAFETY BOLT.

CONSTRUCTION DETAILS OF LAMINATED RAILS & POSTS

Posts shall be of concrete, or treated wood, as specified in the STD. specs. or special provisions. Railings shall meet the requirements in the standard specifications. or Special Provisions.

PAINT — Railings & Posts shall be painted in accordance with the standard specifications. Painting of concrete posts will not be required. End panels to be flared as directed by the Engineer. All hardware except nails to be galvanized. Nail 1st. plank to post (where wood posts are used) with 40 d. nails, 2nd. plank to 1st. with 10 d. nails, 3rd. to 2nd. with 20 d. nails - 4th. to 3rd. with 40 d. nails. Nailing to be on 2 ft. centers staggered top and bottom 2" inside of edge with joints nailed top & bottom.

NOTE — Painting, Nailing etc. & all dimensions same for either alternate (where wood posts are used.)

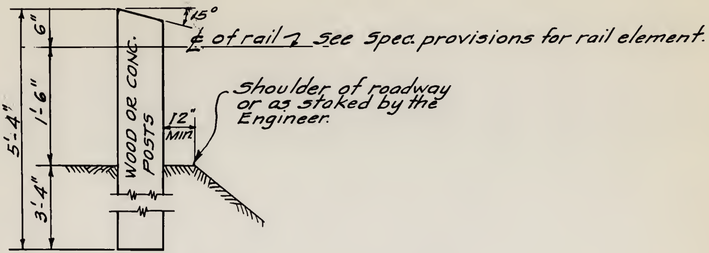
APPROVED SEPT. 1, 1953
Fred Quinnell Jr.
PRECONSTRUCTION ENGINEER

REV. 10-1-51
REV. G-17-53
REV. 7-1-54

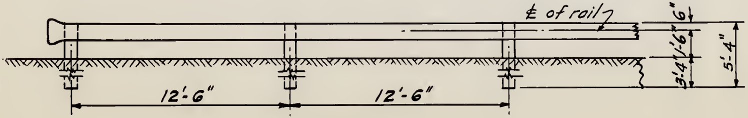
GR1

11

STEEL GUARD RAIL


15°
6"
1'-6"
5'-4"
3'-4"
WOOD OR CONC. POSTS
12" MIN
℄ of rail
See Spec. provisions for rail element.
Shoulder of roadway or as staked by the Engineer.

NOTE:- See plans for type of posts.
For wood or conc guard rail posts see Std. No. 11 GR1.
Concrete posts shall be cast with holes to fasten the type of rail to be used.



ELEVATION

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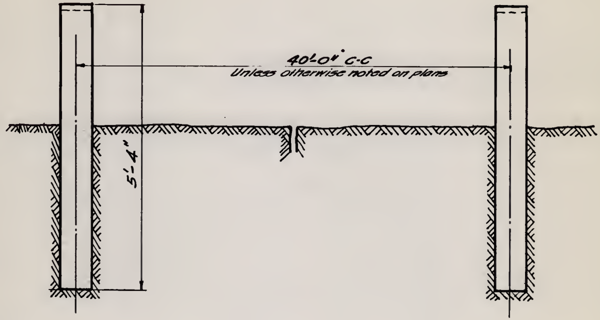
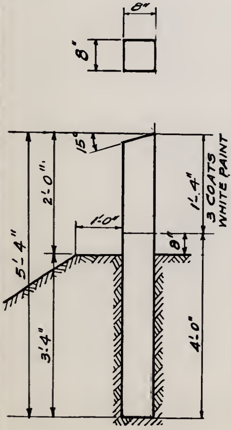
REV. 6-17-53

12
GR2

DETAIL OF WOOD GUIDE POSTS





TREATED POSTS.

POSTS - shall be treated wood as called for in the Std. Spec's. or Special provisions.

LUMBER - to meet the requirements for Posts in the Standard Specifications.

PAINT - Three coats white paint top of post to 8" above ground. (See Std. Spec's.)

UNTREATED POSTS.

POSTS - shall first be painted with 3 coats of approved black paint from bottom to a point 8" above ground line. From this point to top of post paint with 3 coats of approved white paint.

LUMBER - As noted above.

NOTE - On all projects Guide posts to be reflectorized by State forces.

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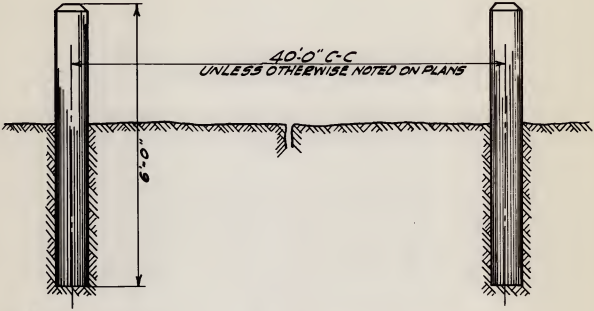
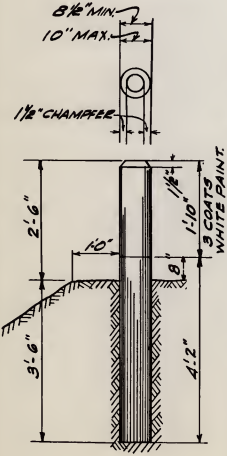
REV. 10-1-51
REV. 10-8-53

ROUND WOOD GUIDE POSTS





TREATED POSTS

POSTS MAY BE OF DOUGLAS FIR, PONDEROSA PINE, NORTHERN WHITE CEDAR, WESTERN RED CEDAR, LARCH OR LODGEPOLE PINE. POSTS SHALL BE STRAIGHT, SOUND, AND FREE FROM DEFECTS OF ALL KINDS, AND SHALL BE CUT FROM LIVE TREES NOT LESS THAN 30 DAYS, NOR MORE THAN 1 YEAR IN ADVANCE OF USE. ALL BARK SHALL BE PEELED AND THE POSTS TRIMMED SMOOTH OF ALL KNOTS AND PROJECTIONS.

POSTS SHALL BE TREATED WOOD AS CALLED FOR IN STD. SPEC'S. OR SPEC. PROV. PAINT—THREE COATS WHITE PAINT FROM TOP OF POST TO 8" ABOVE GROUND. (SEE STD. SPEC'S.)

UNTREATED POSTS.

SHALL FIRST BE PAINTED WITH 3 COATS OF APPROVED BLACK PAINT FROM BOTTOM TO A POINT 8" ABOVE GROUND. FROM THIS POINT TO TOP OF POST PAINT WITH 3 COATS OF APPROVED WHITE PAINT.

NOTE – On all projects – Guide posts to be reflectorized by state forces.

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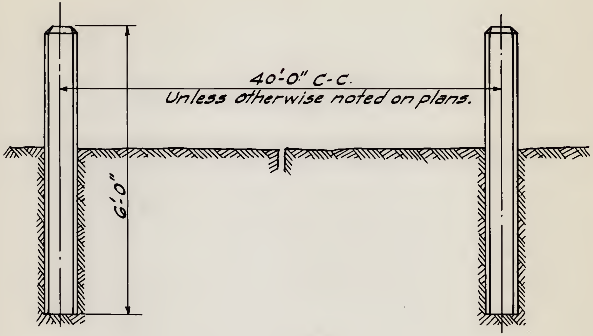
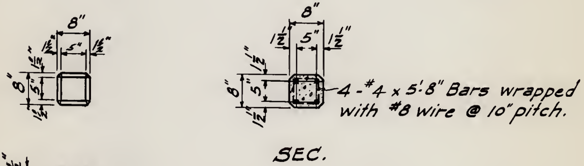
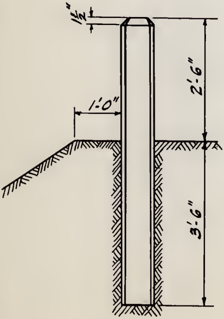
DETAIL OF CONCRETE GUIDE POSTS







Concrete in Posts shall be Class "D" strength or equal.

NOTE- *On all projects Guide posts to be reflectorized by State Forces*

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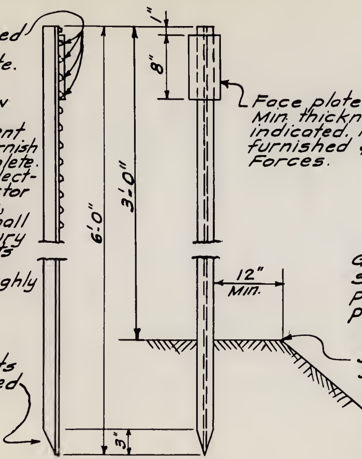
H. C. Helland
CONTROL ENGINEER

REV. 10-1-51

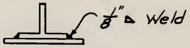
STEEL GUIDE POSTS

4 studs to be burned off flush for installation of plate.

The Unit price bid for new steel guide posts shall in include all labor, equipment & materials required to furnish & install Guide Posts complete in place, exclusive of reflectorization. If the contractor places posts by driving, suitable precautions shall be taken to prevent injury to the posts. If the posts are placed in holes, all back fill shall be thoroughly tamped.



Bottom of posts shall be pointed



Face plate shall be 4" x 8" steel plate of 12 Ga. Min. thickness, securely welded to post as indicated. Reflectorizing material shall be furnished & applied to face plate by State Forces.

Guide Posts shall be approved standard T-Beam, I-Beam or U-Beam providing a min. weight of 1.33 Lbs. per lin. foot.

Shoulder of roadway or as staked by the Engineer.

Posts shall be placed at 40.0' centers or as directed by the Engineer.

Posts shall be painted one shop coat of red lead, one first field or prime coat of red lead, and one final coat of aluminum paint. All paint shall meet the requirements of Sec. 71.06 of the Standard Spec's

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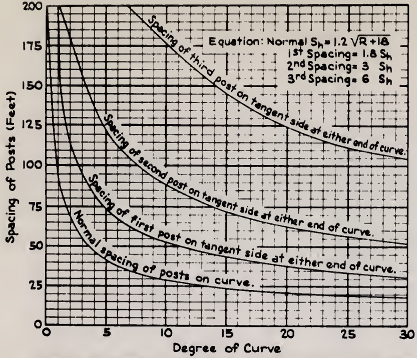
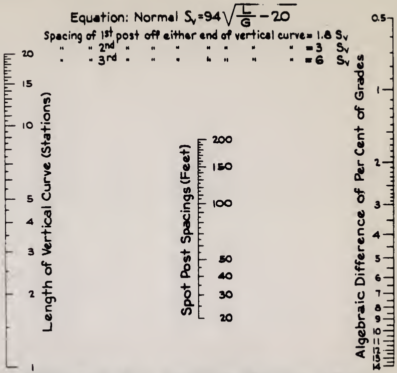
SPACING OF SPOT POSTS



SPACING OF SPOT POSTS ON HORIZONTAL CURVES



SPACING OF SPOT POSTS ON VERTICAL CURVES

NOTES:

The spacing of Spot Posts on tangents beyond the limits of horizontal or vertical curves shall be 200 feet unless otherwise ordered by the Engineer.

Spot Posts shall be timber, Concrete or Steel as called for on the plans or in the Special Provisions.

Delineators are to be furnished & placed by State forces.

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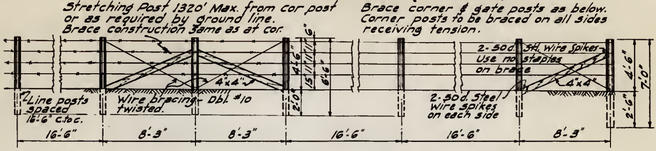
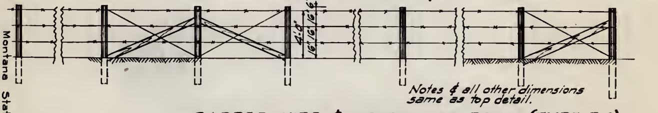
RIGHT OF WAY FENCE

Montana State Highway Commission.

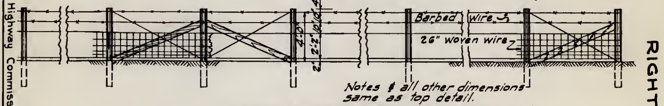
4 WIRE FENCE (TYPE F-4)


Stretching Post 1320' Max. from cor post or as required by ground line. Brace construction same as at cor.
Brace corner & gate posts as below. Corner posts to be braced on all sides receiving tension.
6"
15"
11"
11"
4'-6"
6'-6"
2'-0"
4"x4"
Line posts spaced 16'-6" C. to c.
Wire bracing - Dbl. #10 twisted.
2-50d. Stl. wire spikes
Use no staples on brace
4"x4"
2-50d. Steel wire spikes on each side
4'-6"
7'-0"
2'-6"
16'-6"
8'-3"
8'-3"
16'-6"
16'-6"
8'-3"

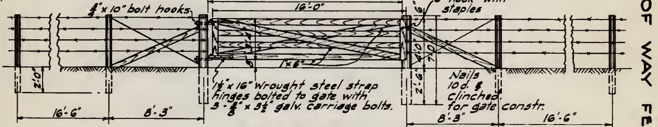
3 WIRE FENCE (TYPE F-3)



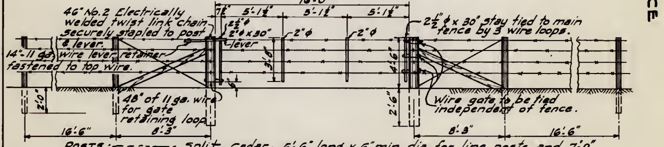
BARBED WIRE & WOVEN WIRE FENCE (TYPE F-2)



FARM ENTRANCE GATE (TYPE G-1)


16'-0"
16'-0"
¾"x 10" bolt hooks
6" Hook with staples
6"
4'-0"
7'-0"
2'-6"
1"x6"
2'-0"
1½"x 16" Wrought steel strap hinges bolted to gate with 3 - ⅜" x 3½" galv. carriage bolts.
Nails 10d. & clinched. for gate constr.
16'-6"
8'-3"
8'-3"
16'-6"

FIELD ENTRANCE GATE (TYPE G-2)


16'-0"
7½"
5'-1½"
5'-1½"
5'-1½"
46" No. 2 Electrically welded twist link chain securely stapled to post & lever.
2½"⌀
2"⌀x30" lever
2"⌀
2"⌀
2½"⌀x 30" stay tied to main fence by 3 wire loops.
14"-11 ga. wire lever retainer fastened to top wire.
3'-6"
4'-6"
6"
2'-0"
48" of 11 ga. wire for gate retaining loop.
2'-6"
Wire gate to be tied independent of fence.
16'-6"
8'-3"
8'-3"
16'-6"

POSTS:– – – – —. Split cedar, 6'-6" long x 6" min. dia. for line posts and 7'-0" long x 8" min. dia. for corner & gate posts.

WIRE:– 2 point galv. barbed wire, approx. 350 lbs. per mile, 2 strands of 12 ga. wire twisted, with barbs spaced 5" apart.
Woven wire 26" wide. Top & bottom wires #10 ga. Lines & stay wires #12½ ga. Stays 12" apart. All wire to be attached to posts on pasture side of fence.

LUMBER: Full sawed Montana Larch, or Montana or Pacific Coast Douglas Fir. Braces may " also be constructed of peeled round poles of a minimum diameter of 4½"
STAPLES: 1½" galvanized fence staples #9 wire.

ALTERNATE CONSTRUCTION.
Metal posts may be used in place of wood posts. Installation will be done according to manufacturers recommendations.
Leaning fence may be substituted if approved by the Engineer.

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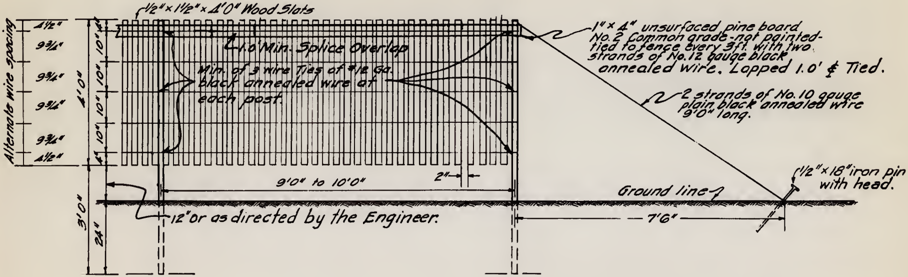
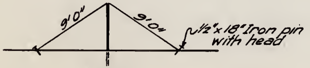
WOVEN WIRE WOOD SLAT SNOW FENCE

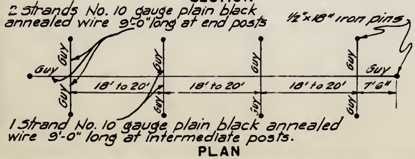


1/2"×1 1/2"×4'0" Wood Slats
4 1/2"
9 3/4"
9 3/4"
9 3/4"
9 3/4"
4 1/2"
Alternate wire spacing
4'0"
10"
10"
10"
10"
4"
4"
1.0' Min. Splice Overlap
Min. of 3 wire Ties of #12 Ga. black annealed wire at each post.
1"×4" unsurfaced pine board No. 2 Common grade - not painted - tied to fence every 3ft. with two strands of No. 12 gauge black annealed wire. Lapped 1.0' & Tied.
2 strands of No. 10 gauge plain black annealed wire 9'0" long.
1/2"×18" iron pin with head.
9'0" to 10'0"
2"
Ground line
3'0"
24"
12" or as directed by the Engineer.
7'6"

METHOD OF GUYING



SECTION



2 strands No. 10 gauge plain black annealed wire 9'-0" long at end posts
1/2"×18" iron pins
Guy
Guy
Guy
Guy
Guy
Guy
Guy
Guy
Guy
Guy
18' to 20'
18' to 20'
18' to 20'
7'6"
1 Strand No. 10 gauge plain black annealed wire 9'-0" long at intermediate posts.

PLAN

Posts: *to be 7'0" long and furnished without anchor. Posts shall be given at least one coat of approved paint. The section form of posts may be tubular, tee, equal angle, tee rail or modified channel provided that all posts weigh at least 1.33 pounds per lineal foot.*

Wood Slats: *1/2"×1 1/2"×4'0" woven together with 5 cables, each consisting of 2 galvanized wires - not smaller than No. 12 1/2 (A S & W gauge). Slats to be placed 2" apart. Each cable to have 2 complete turns in the weave in each space between slats. All slats to be immersed in hot solution of creosote or red oxide of iron.*

Montana State Highway Commission.

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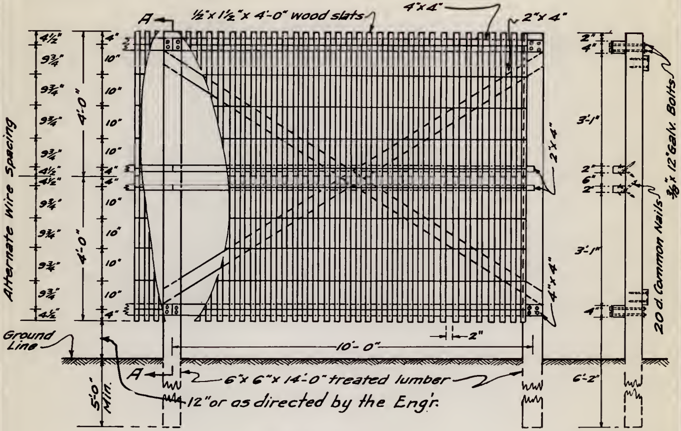
5F1

32

WOVEN WIRE WOOD SLAT SNOW FENCE (DOUBLE HEIGHT)

NOTE:- 2"x4" & 4"x4" bracing cut to fit field staking.



ELEVATION
Scale ⅜" = 1'-0"

SECTION A-A

WOOD SLATS: See Standard Specifications for Wood Slat Snow Fence.

LUMBER: All lumber shall be untreated except 6"x6"x14'-0" posts which shall be treated as called for in the Standard Specifications. All holes shall be bored before treatment. Lumber shall be Pacific Coast Douglas fir or an approved equal and shall be equal to the grade defined as select common in accordance with American Lumber Standards for soft wood lumber.

BOLTS: 4"x4" Stringers to be bolted to 6"x6" Posts with ⅜" Galvanized Bolts using 1½" Diam. Galvanized Washers between all bolt heads and nuts and the wood.

STAPLES: Wood slat snow fence to be stapled to stringers with 1" Galvanized Staples using 21 Staples per row per 10'-0" section.

BRACES: 2"x4" braces to be used at each end section, and at 100' intervals where length of fence permits.

NAILS: 2"x4" stringers and braces to be nailed or toe-nailed to 6"x6" posts with 20d. common nails.

TAMPING: Backfill around posts shall be thoroughly tamped and compacted. Watering shall be resorted to for thorough compaction if required by the Engineer.

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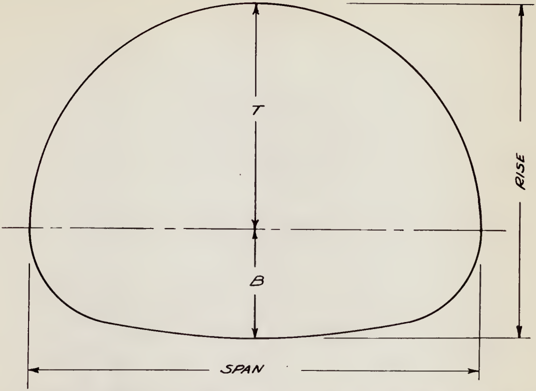
DIMENSIONS OF C.M. PIPE ARCH CULVERTS



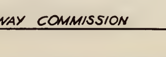
NOTE: Table from Handbook of Culvert & Drainage Practice Armco Dr., etc. 1948- All approved equals are acceptable. A tolerance of plus or minus 1 inch will be permissible in span, rise & "B".

NOTE: ALL DIMENSIONS ARE MEASURED FROM INSIDE CRESTS.

Span In.	Rise In.	Area Sq.ft.	B In.	Height Of Cover In Feet 1	2-4	5-9	10-15	16-20		DIA. OF EQUIV. ROUND PIPE IN INCHES
18	11	1.1	4½	16	16	16	16	16	MIN. REQUIRED GAGE	15
22	13	1.6	4¾	16	16	16	16	16		18
25	16	2.2	5	16	16	16	16	16		21
29	18	2.8	5½	14	14	14	14	14		24
36	22	4.4	6¼	14	14	14	14	14		30
43	27	6.4	7	12	12	12	12	12		36
50	31	8.7	8	12	12	12	12	10		42
58	36	11.4	9¼	10	12	12	10	10		48
65	40	14.3	10½	8	10	10	8	8		54
72	44	17.6	11¾	7	8	8	7	---		60

MIN. COVER ½ RISE TO FIN. GRADE ON SHOULDER.

MULTIPLE INSTALLATIONS



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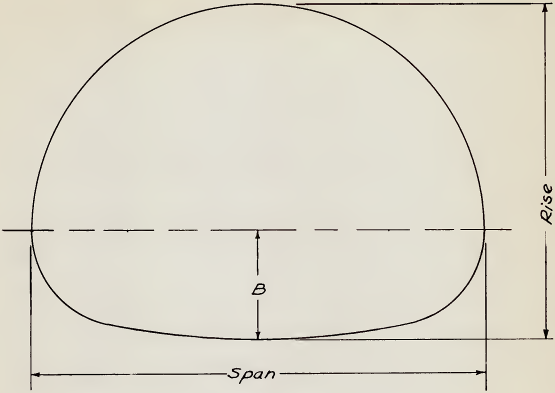
REV. 10-1-51
REV. 8-7-53

DIMENSIONS OF SECTIONAL PLATE PIPE ARCHES

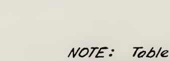


*NOTE: Table from Handbook of Culvert & Drainage Practice Armco Dr., etc. 1948
All approved equals are acceptable.*

Span	Rise	Area Sq. Ft.	B In.
77"	57"	23.8	$18\frac{1}{2}$
93"	64"	33.3	$20\frac{1}{2}$
107"	72"	42.7	20
123"	77"	54.5	22
142"	90"	70.0	23
159"	96"	84.8	25
170"	104"	95.9	$25\frac{1}{2}$
189"	115"	114.3	$26\frac{1}{2}$

*NOTE: All dimensions are measured from inside crests.
Min. Cover $\frac{1}{2}$ Rise from top of pipe to fin. grade on Shoulder.*

MULTIPLE INSTALLATIONS



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Fred Quinnell Jr.
PRECONSTRUCTION ENGINEER

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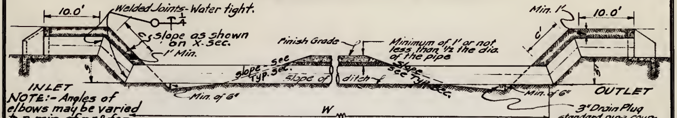
REV. 10-1-51
REV. 8-7-53

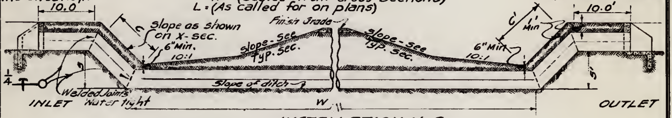
CORRUGATED METAL PIPE SYPHON


10.0'
Welded Joints-Water tight.
$\frac{1}{4}$
C
Slope as shown on X-Sec.
1' Min.
S
Finish Grade
Minimum of 1' or not less than ½ the dia. of the pipe
Slope-see Typ. Sec.
Slope of ditch
Slope see Typ. Sec.
Min. of 6"
Min. 1'
10.0'
C'
S'
Min. of 6"
INLET
OUTLET
W
3" Drain Plug standard pipe coupling welded to pipe and fitted with standard pipe plug secured to barrel of pipe with swivel & chain

NOTE:- Angles of elbows may be varied to a min. of 25° for special installations to make S or S' fit the situation.

INSTALLATION NO. 1

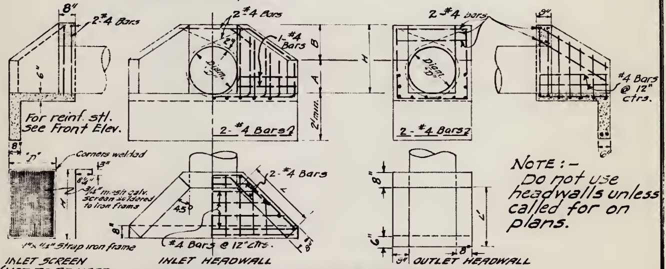
Length of Syphon Pipe = W+C+C'+20'
W = (Scaled from cross sections)
L = (As called for on plans)



INSTALLATION No. 2

To be used where Installation No. 1 is not possible due to less than minimum S-S' or less than minimum cover.

Payment for pipe to be made for length measured along ℄ of pipe



NOTE:- Do not use headwalls unless called for on plans.

All exposed corners of concrete to be chamfered 1"
Reinforcing steel to be not less than 1½" to nearest face of concrete

Screen to be included in the Unit Price bid for Lin. Ft. of pipe.

INLET & OUTLET HEADWALLS FOR C.M.P.

* SYPHON PIPE			CL. "AD" CONC. CU. YDS.		REINF. STL. LBS.		DIMENSION TABLE					
DIA. "D"	AREA SQ. FT.	MIN. C or C'	INLET	OUTLET	INLET	OUTLET	L	L'	A	B	H	⊕ GAGE
18"	1.77	2.0	.73	.59	62	50	2'-6"	2'-2"	1'-3"	1'-3"	2'-6"	16
24"	3.14	2.0	.91	.76	82	54	3'-0"	2'-6"	1'-6"	1'-6"	3'-0"	14
30"	4.91	2.0	1.06	.95	99	66	3'-6"	2'-10"	1'-9"	1'-9"	3'-6"	14
36"	7.07	2.0	1.68	1.11	116	82	4'-0"	3'-2"	2'-0"	2'-0"	4'-0"	12
42"	9.62	2.0	2.10	1.40	139	105	4'-6"	3'-6"	2'-3"	2'-3"	4'-6"	12
48"	12.57	2.0	2.32	1.66	162	124	5'-0"	3'-10"	2'-6"	2'-6"	5'-0"	10

⊕ For fills under 10.0'
* Syphon pipe to be corrugated metal, close riveted and soldered water-tight
Reinforcement steel as indicated to be included in the unit price bid per cu. yd. of conc.
Maximum S or S' = 10'.

Or Reinf. Conc. Syphon pipe as called for in the Standard Specifications.
See Std. 93-53 for RCP Headwalls.

NOTE:- Field connections will not be allowed within 15 feet of the centerline of the road.

Montana State Highway Commission

APPROVED SEPT. 1, 1953
PRECONSTRUCTION ENGINEER

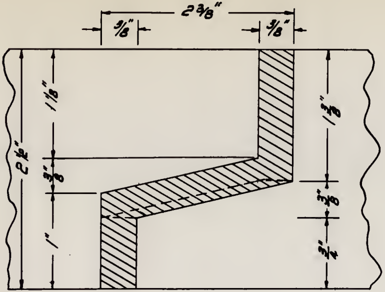
REV. 10-1-51
REV. 8-7-53

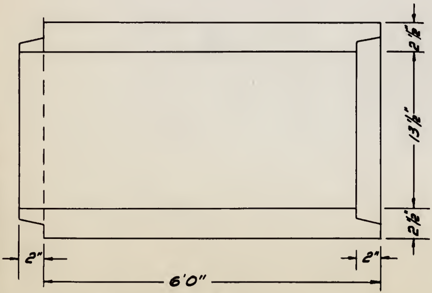
Montana State Highway Commission

22" SPAN × 13½" RISE CONCRETE PIPE ARCH CULVERT

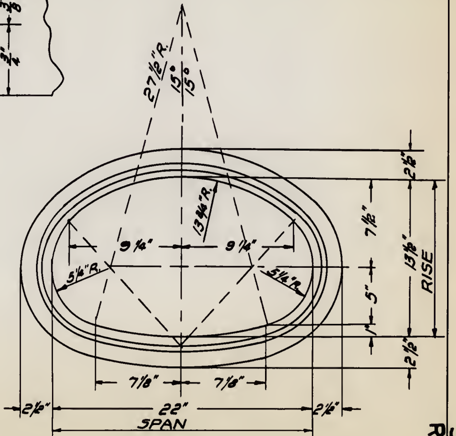
(Equivalent to 18" Circular Pipe)

SECTION OF PALLET FULL SIZE





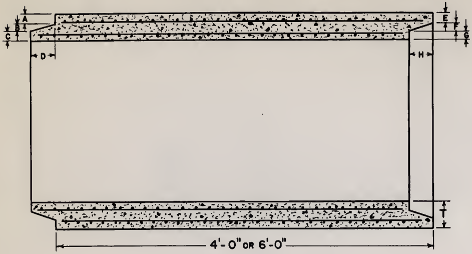
LONGITUDINAL SECTION ON ℄



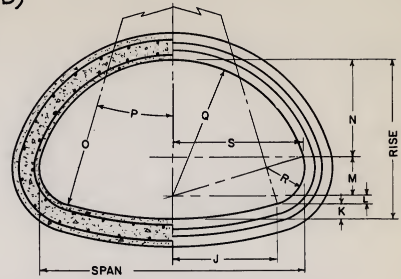
TRANSVERSE SECTION

APPROVED - JAN. 1, 53
CONTROL ENGINEER

REINFORCED CONCRETE PIPE ARCH CULVERTS
(PREFABRICATED)



LONGITUDINAL SECTION



TRANSVERSE SECTION & END VIEW

SIZE	WATER AREA SQ. FT.	RISE	SPAN	As*	T	A	B	C	D	E	F	G	H	J	K	L	M	N	O	P	Q	R	S
36"	6.4	26⅝"	43¾"	0.25	4½"	2"	¾"	1¾"	4"	1¾"	¾"	2"	4"	17⅛"	2⅜"	1¾"	6¼"	16¼"	62"	16°-00'	22½"	6½"	21⅝"
42"	8.8	31 5/16"	51⅛"	0.30	4½"	2"	¾"	1¾"	4"	1¾"	¾"	2"	4"	20"	2¾"	2 5/16"	7 3/16"	19 1/16"	73"	15°-15'	26¼"	7¾"	25¼"
48"	11.4	36"	58½"	0.33	5"	2¼"	¾"	2"	5"	2"	¾"	2¼"	5"	22¾"	3⅛"	2⅞"	8⅛"	21⅞"	84"	15°-40'	30"	8⅞"	28⅞"
60"	17.7	45"	73½"	0.40	6"	3 5/16"	¾"	1 15/16"	5"	2¾"	¾"	2½"	5"	28½"	3 15/16"	3 9/16"	10 3/16"	27 5/16"	105"	15°-45'	37½"	11 1/16"	36⅛"
72"	25.6	54"	88"	0.59	7"	3 13/16"	1"	2 3/16"	6"	3¼"	1"	2¾"	6"	34 3/16"	4¾"	4¼"	12¼"	32¾"	126"	15°-45'	45"	13 5/16"	43 5/16"

NOTE: For R.C. Flared End Sections
See Std. sheet No. 77 - C73

*As = MINIMUM REINFORCEMENT FOR EACH
OF THE TWO LINES - STEEL AREA IN
SQUARE INCHES PER LINEAL FOOT
OF PIPE BARREL

CONCRETE - 3500 P.S.I.

Montana State Highway Commission

APPROVED SEPT. 1, 1953
Fred Quinnell Jr.
PRECONSTRUCTION ENGINEER

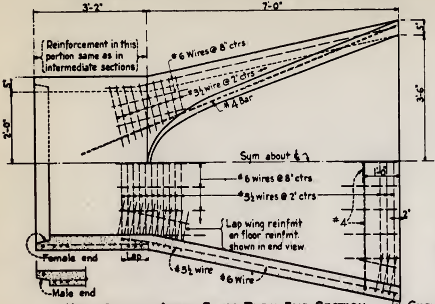
52
RC

REV. 10-5-53

STANDARD SECTIONAL REINF. CONC. UNDERPASS

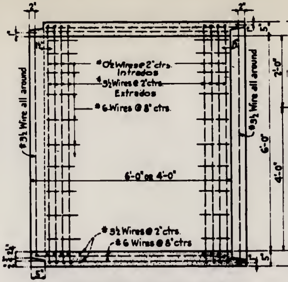
Construction methods, reinforcing steel, concrete, methods of measurement & basis of payment shall conform to the specifications for Reinforced Concrete Pipe Culverts....

HALF PLAN OF END SECTION - SHOWING WING WALL REINFMT.

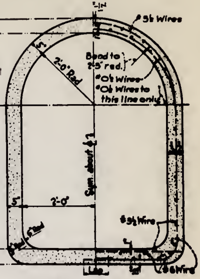


HALF SECTION ABOVE FLOOR THRU END SECTION

Gravel Backfill, when called for, shall conform to the Std. Specs. or as specified for sectional plate pipe culverts~



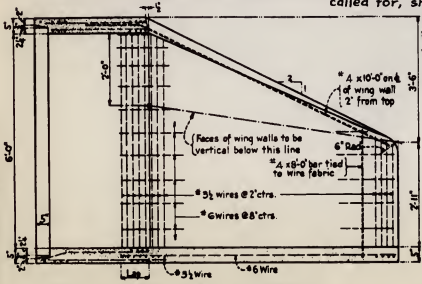
LONGITUDINAL SECTION ON ℄



TRANSVERSE SECTION

DETAILS OF INTERMEDIATE SECTIONS

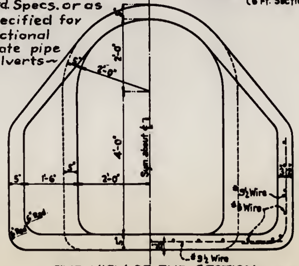
EST. WEIGHT { 4 FT. SECTION 4950 LBS.
6 FT. SECTION 7420 LBS.


½"
5"
2½"
2'-0"
#4 x 10'-0" on ℄ of wing wall 2" from top
2
1
3'-6"
6'-0"
Faces of wing walls to be vertical below this line
6" Rad.
#4 x 8'-0" bar tied to wire fabric
#3½ wires @ 2" ctrs.
#6 wires @ 8" ctrs.
2'-11"
5"
5"
Lap
#3½ Wire
#6 Wire

LONGITUDINAL SECTION ON ℄ OF END SECTION

CONCRETE - 4500 LBS. PER SQ. IN.

STL. FABRIC - AASHO SPEC'S. M-55



END VIEW OF END SECTION ~
EST. WEIGHT OF END SECT. 10,650 LBS.

MEASURED ALONG F.L., WHEN END SECTIONS ARE CALLED FOR, THEY ARE TO BE MEASURED AND PAID FOR AT THE UNIT PRICE BID FOR STANDARD SECTIONAL REINFORCED CONCRETE UNDERPASS~

Construction Notes:-

If the splices are not electrically welded, the reinforcement shall be lapped not less than 40 diameters.

If the splices are electrically welded, the members at either a welded splice or intersection shall develop a tensile strength across the weld not less than the minimum required strength of the fabric.

Four foot lengths shall be used only to secure required length of culvert. Short lengths of pipe shall be installed near ends of culvert.

Not more than two 4 ft. sections shall be used in any culvert.

Cover over top of U-Pass min. 1'-0". max. 15'-0".

Montana State Highway Commission

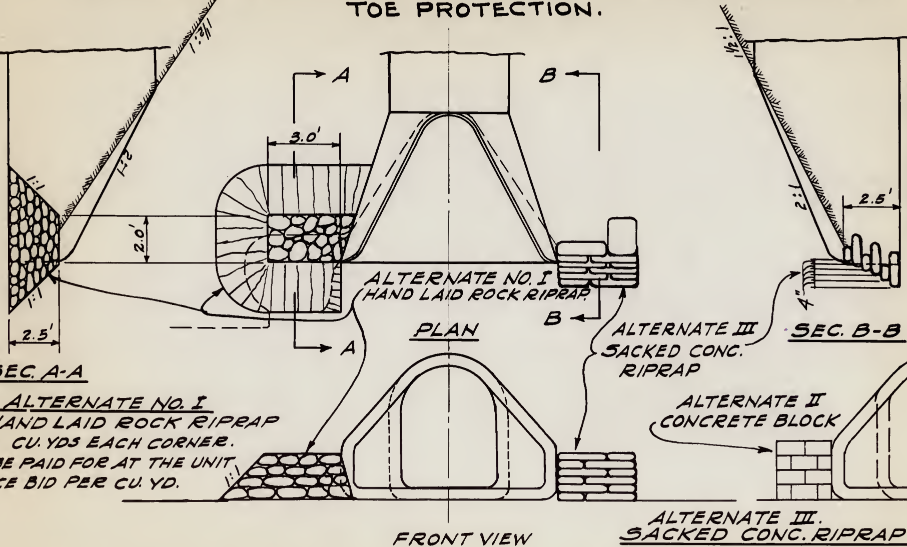
APPROVED - JAN. 1, 53
CONTROL ENGINEER
REV. 10-1-51

53
RC

STANDARD SECTIONAL REINFORCED CONCRETE UNDERPASS TOE PROTECTION.

Montana State Highway Commission.

APPROVED - JAN. 1, 53
CONTROL ENGINEER



ALTERNATE NO. I

HAND LAID ROCK RIPRAP

2.0 CU. YDS EACH CORNER.
TO BE PAID FOR AT THE UNIT PRICE BID PER CU. YD.

ALTERNATE III. SACKED CONC. RIPRAP

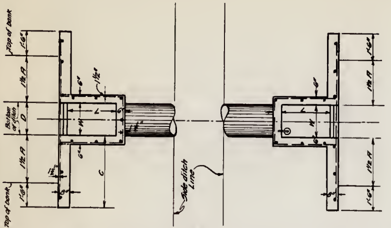
MIN. 12 SACKS EACH CORNER

CONCRETE IN SACKS TO BE SAME PROPORTION OF AGGREGATES AND CEMENT AS USED IN CONC. PIPE. TO BE INCLUDED IN THE UNIT PRICE BID FOR CONC. U-PASS.

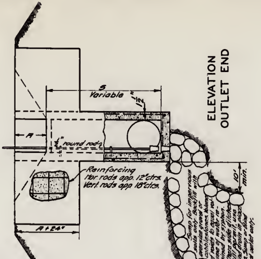
ALTERNATE II - CONCRETE BLOCK

TO BE MADE OF 10, 8"x 8"x 16" CONCRETE BLOCKS, MEETING A.S.T.M. SPECIFICATION C 90-44 GRADE B, AT EACH CORNER, LAID WITH A 1.0' BATTER. MORTAR SHALL CONSIST OF 1 PART HYDRATED LIME, 6 PARTS OF SAND & 1 PART CEMENT. TO BE INCLUDED IN THE UNIT PRICE BID FOR CONC. U-PASS.

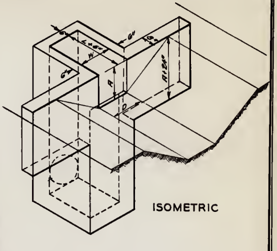
REINFORCED CONCRETE SYPHON



PLAN

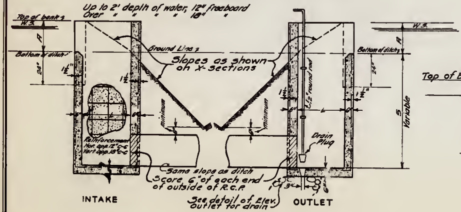

S
Variable
1½"
A
½" round rod
Reinforcing
Hor. rods app. 12" ctrs.
Vert. rods app. 18" ctrs.
A+24"
10' min.
Sump for impervious soils only. Backfill with oversize gravel or cobblestones. Volume of voids to equal volume of water retained by syphon. Where side ditches will permit, use blind drain in place of sump. Sump or blind drain at outlet only.

ELEVATION OUTLET END



ISOMETRIC

NOTES: "W" minimum = 24"; above 24" "W" = outside diameter of pipe or inside width of box.
"L" = 36" minimum to increase as necessary to make areas of cross section of box and well equal.
When "S" exceeds 4', inside face of well to be reinforced the same as outside face. In no case shall "S" exceed 6'. Reinforce with #5 steel as shown.
Concrete = Class "AD"
All exposed corners of concrete to be chamfered 1".

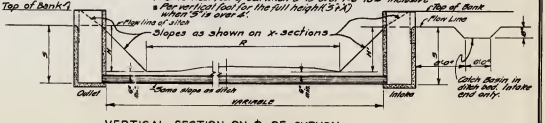

Up to 2' depth of water, 12" freeboard
Over " " " " 18" "
Top of bank
W.S.
A
Bottom of ditch
24"
1½"
Ground Line
Slopes as shown on X-sections
1½"
Reinforcement Hor. app. 12" c-c Vert. app. 18" c-c
minimum
6"
minimum
½" round rod
1½"
L
1½"
Drain Plug
W.S.
Bottom of ditch
A
24"
S
Variable
Same slope as ditch
Score 6" of each end of outside of R.C.P.
3"
6"
See detail of Elev. outlet for drain

INTAKE OUTLET

LONGITUDINAL SECTION

● SIZE OF PIPE	DIMENSIONS						QUANTITIES (INTAKE + OUTLET)						AREA PIPE SQ. FT.	GAGE ⊗
	S	L	W C.M.P.	W R.C.P.	A	C	CU. YDS. CLASS "AD" CONC. C.M.P.	CU. YDS. CLASS "AD" CONC. R.C.P.	LBS STEEL	PER VERT. FT. OF BOX CU. YDS. CONC. C.M.P. *	PER VERT. FT. OF BOX CU. YDS. CONC. R.C.P. *	PER VERT. FT. OF BOX LBS. STEEL * ■		
18"	1'-6"	3'-0"	2'-0"	2'-0"	1'-11"	4'-4½"	3.25	3.25	276	0.44	0.44	39 – 71	1.77	16
24"	1'-6"	3'-0"	2'-0"	2'-6"	2'-7"	5'-4½"	4.16	4.28	325	0.44	0.48	39 – 71	3.14	14
30"	1'-6"	3'-0"	2'-0"	3'-1"	3'-0"	6'-0"	4.94	5.06	394	0.48	0.52	44 – 78	4.91	14
36"	1'-6"	3'-0"	2'-0"	3'-8"	3'-5"	6'-7½"	5.77	5.90	471	0.52	0.57	46 – 82	7.07	12

⊗ For fills under 10.0'
● Corrugated metal close riveted and soldered water tight (Syphon Pipe) Reinf. conc. Syphon pipe as called for in the Standard Specifications.
* Per vertical foot of box when "S" is over 1'-6" to 4' inclusive
■ Per vertical foot for the full height ("S"+"A") when "S" is over 4'.



VERTICAL SECTION ON ℄ OF SYPHON
MINIMUM LENGTH OF PIPE NEEDED = R+H+H'

Berm may be left between Syphon well and top of cut slope.

APPROVED SEPT. 1, 1953
Fred Quinnell Jr.
PRECONSTRUCTION ENGINEER

M8b

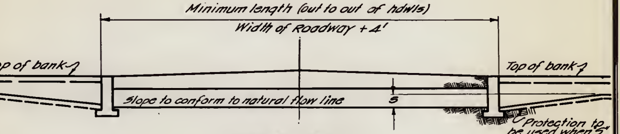
61

Montana State Highway Commission

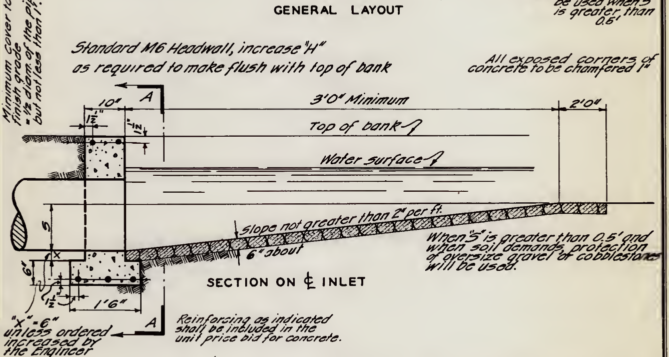
REV. 10-1-51
REV. 8-7-53

CONVERTED CULVERT SYPHON

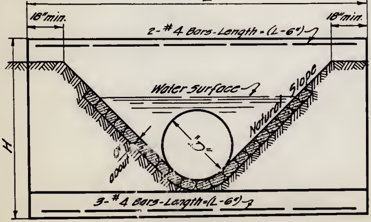
(Use when "S" is 12" or less)


Minimum length (out to out of hdwls)
Width of Roadway + 4'
Top of bank
Top of bank
Slope to conform to natural flow line
S
Protection to be used when "S" is greater than 0.5'

GENERAL LAYOUT


Minimum cover to finish grade = 1/2 diam of the pipe but not less than 1'.
Standard M6 Headwall, increase "H" as required to make flush with top of bank
All exposed corners of concrete to be chamfered 1"
A
10"
$1\frac{1}{2}$"
$1\frac{1}{2}$"
3'0" Minimum
2'0"
Top of bank
Water surface
S
Slope not greater than 2" per ft.
6" about
When "S" is greater than 0.5' and when soil demands, protection of oversize gravel or cobblestones will be used.
X
6"
$1\frac{1}{2}$"
1'6"
A
"X" = 6" unless ordered increased by the Engineer
Reinforcing as indicated shall be included in the unit price bid for concrete.

SECTION ON ℄ INLET



SECTION A-A

Where "S" is greater than 0.5' or when soil demands, protection of oversize gravel or cobblestones will be used. Should the natural slope of ditch banks be such that the protection will not stand, use cement grout.

⊗ For fills under 10.0'

Diam. * of Pipe	"L"	Class "AD" Concrete		GAGE ⊗
		Conc. in 2 M6 Hdwls. X = 6"	Conc. 2-Hdwls. for 1/4 ft. Additional 'H'	
18"	6'0"	1.34	0.092	16
24"	8'0"	1.98	0.123	14
30"	10'0"	2.72	0.154	14
36"	12'0"	3.56	0.185	12

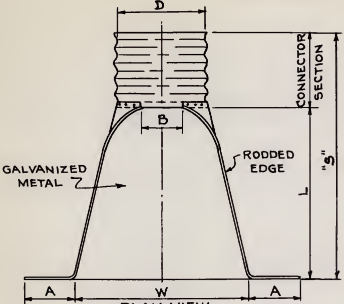
* Syphon pipe to be corrugated metal, close riveted and soldered water-tight.
Or Reinf. Conc. syphon pipe as called for in the Standard Specifications.

APPROVED SEPT. 1, 1953
Fred Quinnell Jr.
PRECONSTRUCTION ENGINEER

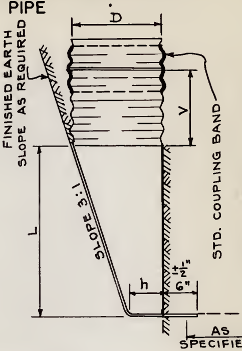
REV. 10-1-51
REV. 8-7-53

FLARED END TERMINAL SECTION (PREFABRICATED) FOR CORRUGATED METAL PIPE

* STYLE "A"

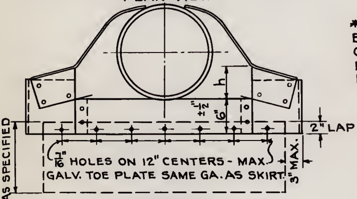


PLAN VIEW



CROSS SECTION VIEW.

*- STYLE "A" AND STYLE "B" EITHER STYLE ACCEPTABLE DEPENDING ON MANUFACTURER SPECIFICATIONS. F.E.T.S. TO BE INCLUDED IN LENGTH OF PIPE AS SHOWN ON PLANS.


h
±1/2"
6"
2" LAP
AS SPECIFIED
7/16" HOLES ON 12" CENTERS - MAX.
GALV. TOE PLATE SAME GA. AS SKIRT.
3" MAX.

ELEVATION.

TOE PLATE TO BE PUNCHED WITH 7/16" HOLES TO MATCH HOLES IN SKIRT LIP. 3/8" GALV. BOLTS TO BE FURNISHED. LENGTH OF TOE PLATE EXT. SHOWN ON PLANS. AVAILABLE STANDARD DEPTHS - 12", 15", 18", 24", 30", 36" & 48".

TOE PLATE EXTENSIONS TO BE USED ONLY WHEN SPECIFIED.

SKIRT SECTION FOR 12" TO 24" DIA. PIPE INCL. TO BE MADE IN ONE PIECE.

SKIRT SECTION FOR 30" TO 48" DIA. PIPE INCL. MAY BE MADE FROM TWO SHEETS WITH LAP RIVETED SPLICE ON ℄.

CULV. DIA.	DIMENSIONS						
	"A" (MIN.)	"B" (MAX.)	"L" (2" TOL)	"W" (2" TOL.)	"h" (1/2" TOL.)	"V" 2" TOL	"S" 2" TOL.
12"	9"	6"	24"	24"	4"	12"	36"
15"	9"	7½"	30"	30"	5"	6"	36"
18"	9"	9"	36"	36"	6"	12"	48"
24"	9"	12"	46"	48"	8"	12"	58"
30"	9"	15"	60"	59"	10"	12"	72"
36"	14"	18"	72"	70"	12"	12"	84"
42"	14"	21"	84"	82"	14"	12"	96"
48"	14"	24"	96"	94"	16"	12"	108"

CONNECTOR SECTION, SKIRT, CORNER PLATES AND TOE PLATE TO BE GALV. ~~AND SAME GAGE AS PIPE.~~

F.E.T.S. TO BE INCLUDED IN LENGTH OF PIPE AS SHOWN ON PLANS.

DELETE RODDED ENDS ON ALL PIPE USING FLARED END SECTIONS.

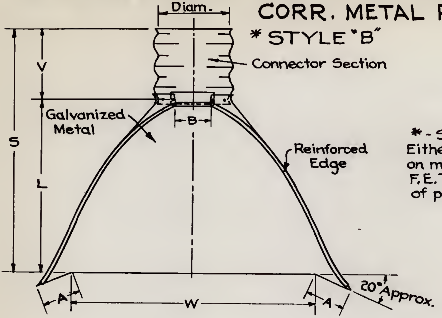
Montana State Highway Commission.

APPROVED - JAN. 1, 53
H. C. Holland
CONTROL ENGINEER

REV. 12-3-49
REV. 10-1-51

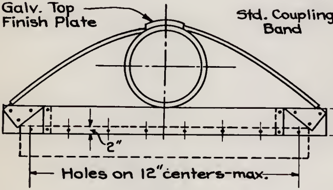
FLARED END TERMINAL SECTION (PREFABRICATED) FOR CORR. METAL PIPE.

* STYLE "B"

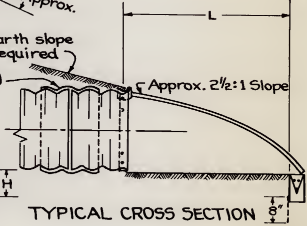


PLAN

* - Style "A" and Style "B" Either style acceptable depending on manufacturer specifications. F. E. T. S. to be included in length of pipe as shown on plans.



ELEVATION



TYPICAL CROSS SECTION

PIPE DIAM.	GA.	DIMENSIONS						
		A 1" TOL.	B MAX.	H 1" TOL.	L 1½" TOL.	W 2" TOL.	V 2" TOL.	S 2" TOL.
12"	16	4¾"	6"	6"	21"	24"	15"	36"
15"	16	6"	8"	6"	26"	30"	10"	36"
18"	16	7"	9"	6"	31"	36"	17"	48"
24"	14	9½"	12"	6"	42"	48"	16"	58"
30"	14	12"	15"	7½"	52½"	60"	19½"	72"
36"	12	14"	18"	9"	63"	72"	21"	84"
42"	12	16"	21"	10½"	73½"	84"	22½"	96"
48"	12	18"	27"	12"	84"	90"	24"	108"

Toe Plate, where needed, to be punched to match holes in skirt lip. ⅜" galv. bolts to be furnished. Length of toe plate is W+10" for 12" to 30" dia. pipe incl. and W+22" for 36" to 48" dia. pipe incl.

Skirt section for 12" to 24" dia. pipe incl. to be made in one piece.

Skirt section for 30" to 48" dia. pipe incl. may be made from two sheets joined by riveting or bolting on center line.

Connector Section, Corner Plate and Toe Plate to be same gage as skirt and each to be galvanized.

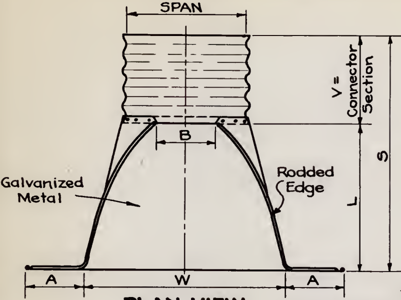
Delete rodded ends on all pipe using Flared End Sections.

APPROVED - JAN. 1, 53
CONTROL ENGINEER

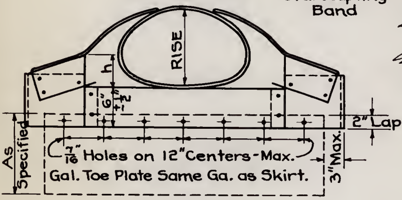
Montana State Highway Commission

3-28-52

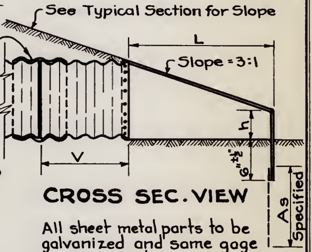
FLARED END TERMINAL SECTION (PREFABRICATED) FOR CORRUGATED METAL PIPE-ARCH CULVERT



PLAN VIEW


RISE
h
6" ± 1/2"
2" Lap
As Specified
7/16" Holes on 12" Centers-Max.
Gal. Toe Plate Same Ga. as Skirt.
3" Max.

ELEVATION



CROSS SEC. VIEW

NOTE—Toe plate to be used only when specified.

PIPE ARCH DIMENSIONS		DIMENSIONS						
SPAN	RISE	"A" (Min.)	"B" (Max.)	"L" (2" Tol.)	"W" (2" Tol.)	"h" (½" Tol.)	"V"	"S"
18"	11"	9"	9"	22"	30"	3¾"	14"	36"
22"	13"	9"	10"	26"	36"	4½"	10"	36"
25"	16"	9"	11½"	31"	42"	5¼"	17"	48"
29"	18"	9"	13¾"	36"	48"	6"	12"	48"
36"	22"	9"	16"	44"	60"	7¼"	14"	60"
43"	27"	14"	17½"	54"	73"	9"	18"	72"
50"	31"	14"	20"	62"	86"	10¼"	10"	72"
58"	36"	14"	22"	72"	100"	12"	12"	84"
65"	40"	14"	23"	80"	113"	13¼"	16"	96"
72"	44"	14"	24"	88"	128"	14¾"	20"	108"

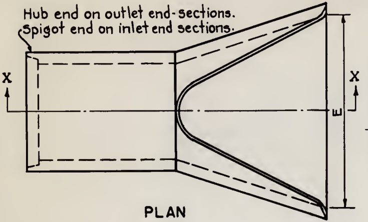
All sheet metal parts to be galvanized and same gage as Pipe-Arch.
Delete rodded ends on all pipe using flared end sections.
Toe plate to be punched with 7/16" holes to match holes in skirt lip. 3/8" galvanized bolts to be furnished. Length of toe plate as shown on plans. Available standard depths - 12", 15", 18", 24", 30", 36" & 48".
Skirt section for Pipe-Arches with Rise of 11" to 22" incl. to be made in one piece.
Skirt section for Pipe-Arches with Rise of 27" to 36" incl. may be made from two sheets with lap riveted splice on ℄.
Skirt section for Pipe-Arches with Rise of 40" to 44" incl. may be made from three sheets with lap riveted splices at equal distances from ℄.
F.E.T.S. to be included in length of pipe as shown on plans.

APPROVED - JAN. 1, 53
CONTROL ENGINEER

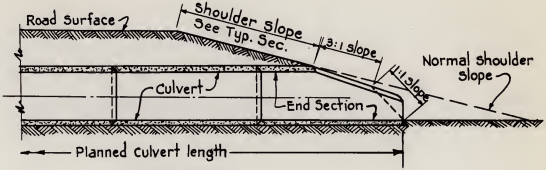
Montana State Highway Commission

FLARED END TERMINAL SECTION
FOR REINFORCED SECTIONAL CONCRETE PIPE
(PREFABRICATED)

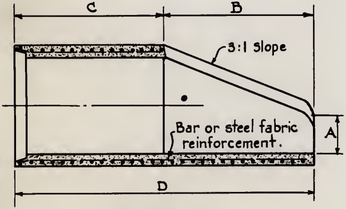
Montana State Highway Commission.


Hub end on outlet end-sections.
Spigot end on inlet end sections.
X
X
E

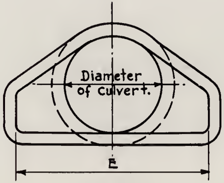
PLAN



SLOPE DETAIL



SECTION X-X



END VIEW

END- SECTION DIMENSIONS					
DIAM.	A	B	C	D	E
12"	4"	2'-0"	4'-0 7/8"	6'-0 7/8"	2'-0"
15"	6"	2'-3"	3'-10"	6'-1"	2'-6"
18"	9"	2'-3"	3'-10"	6'-1"	3'-0"
24"	9 1/2"	3'-7 1/2"	2'-6"	6'-1 1/2"	4'-0"
30"	1'-0"	4'-6"	1'-7 3/4"	6'-1 3/4	5'-0"
36"	1'-3"	5'-3"	2'-10 3/4"	8'-1 3/4	6'-0"
42"	1'-9"	5'-3"	2'-11"	8'-2"	6'-6"
48"	2'-0"	6'-0"	2'-2"	8'-2"	7'-0"
* 60"	2'-6"	5'-0"	3'-3"	8'-3"	8'-0"

* 60" Special end section is based on the slope of a wing 2 to 1.

NOTE :- Reinforcing Steel & Concrete shall conform to Specifications for Reinforced Conc. Pipe.
F.E.T.S. To be included in length of pipe as shown on plans.

APPROVED - JAN. 1, 53
CONTROL ENGINEER

REV. 10-1-51

C7

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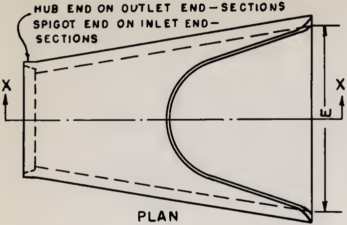
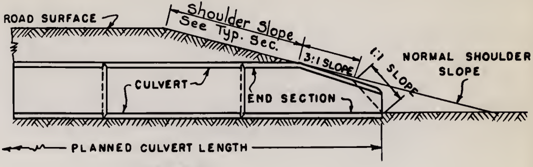
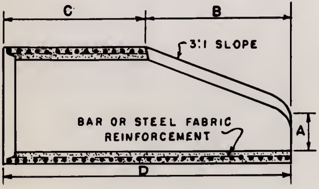
Montana State Highway Commission


HUB END ON OUTLET END-SECTIONS
SPIGOT END ON INLET END-SECTIONS
X
X
E

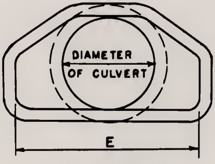
PLAN



SLOPE DETAIL



SECTION X-X



END VIEW

END SECTION DIMENSIONS					
DIAM	A	B	C	D	E
12"	4"	2'-0"	4'-0 7/8"	6'-0 7/8"	2'-0"
15"	6"	2'-3"	3'-10"	6'-1"	2'-6"
18"	9"	2'-3"	3'-10"	6'-1"	3'-0"
24"	9 1/2"	3'-7 1/2"	2'-6"	6'-1 1/2"	4'-0"
30"	1'-0"	4'-6"	1'-7 3/4"	6'-1 3/4"	5'-0"
36"	1'-3"	5'-3"	2'-10 3/4"	8'-1 3/4"	6'-0"
42"	1'-9"	5'-3"	2'-11"	8'-2"	6'-6"
48"	2'-0"	6'-0"	2'-2"	8'-2"	7'-0"
* 60"	2'-6"	5'-0"	3'-3"	8'-3"	8'-0"

*60 Special end section is based on the slope of a wing 2:1

NOTE:- REINFORCING STEEL & CONCRETE SHALL CONFORM TO SPECIFICATIONS FOR REINFORCED CONC. PIPE.
F.E.T.S. TO BE INCLUDED IN LENGTH OF PIPE AS SHOWN ON PLANS.

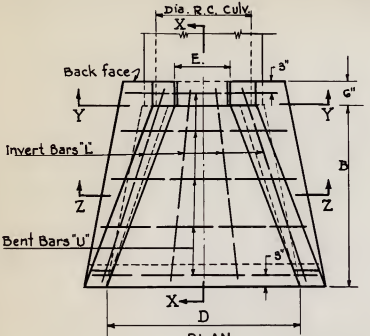
FLARED END TERMINAL SECTION
FOR REINFORCED SECTIONAL CONC. PIPE
(PREFABRICATED).

APPROVED - JAN. 1, 53
CONTROL ENGINEER
REV. 10-1-51

C71

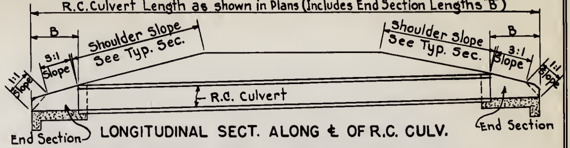
Montana State Highway Commission

FLARED END TERMINAL SECTION FOR REINFORCED CONC. PIPE (CAST IN PLACE)



PLAN

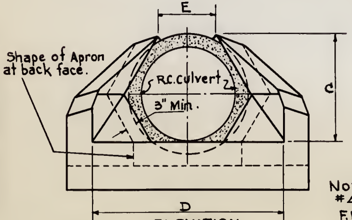
Showing Reinforcing in invert of Apron. Sidewall Reinforcing not shown.


R.C. Culvert Length as shown in Plans (Includes End Section Lengths "B")
B
Shoulder Slope See Typ. Sec.
Shoulder Slope See Typ. Sec.
B
3:1 Slope
1:1 Slope
3:1 Slope
1:1 Slope
R.C. Culvert
End Section
End Section

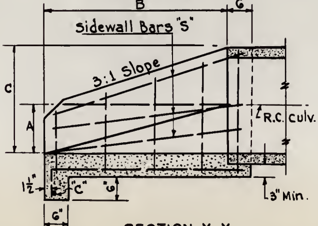
LONGITUDINAL SECT. ALONG ℄ OF R.C. CULV.

ESTIMATE QUANTITIES							GENERAL DIMENSIONS					
CULV. DIA.	CONC.	STL.	NO. REINF. BARS.				A	B	C	D	E	T
			C	L	S	U						
12"	0.2 C.Y.	26 Lb	1	3	6	3	6"	2'-0"	1'-2"	2'-0"	6¾	6"
15"	0.3 "	35 "	1	4	6	4	7½	2'-5¼"	1'-5¼"	2'-6"	8¼	6"
18"	0.4 "	42 "	1	4	6	4	9"	2'-10½	1'-8½"	3'-0"	9¾	6"
24"	0.6 "	58 "	1	4	6	5	12"	3'-9"	2'-3"	4'-0"	12¾	6"
30"	1.0 "	77 "	1	4	6	6	15"	4'-7½	2'-9½	5'-0"	15¾	6½"
36"	1.4 "	87 "	1	4	6	6	18"	5'-6"	3'-4"	6'-0"	18	7"
42"	1.9 "	107 "	1	4	6	7	21"	6'-4½	5'-10½	6'-6"	21¼	7½
48"	2.4 "	136 "	1	5	6	8	24"	7'-3"	4'-5"	7'-0"	23¾	8"
* 60"	3.0 "	160 "	1	5	6	8	30"	6'-6"	5'-6"	7'-4	30"	10"

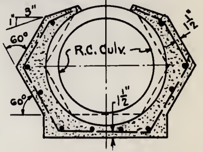
*60" Special end section is based on the slope of a wing 2:1.



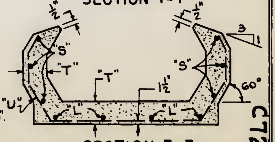
ELEVATION



SECTION X-X



SECTION Y-Y



SECTION Z-Z

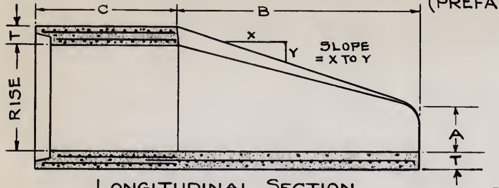
NOTE: The reinforcement steel to be #4 deformed bars. Conc. to be class "D". F.E.T.S. to be included in length of pipe as shown on plans.

APPROVED - JAN. 1, 53
CONTROL ENGINEER
REV. 10-1-51

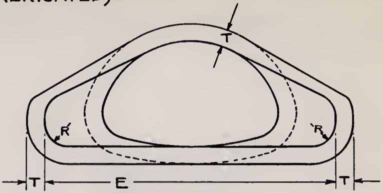
C72

Montana State Highway Commission

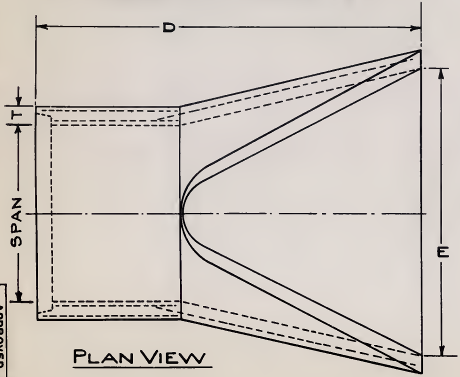
FLARED END SECTIONS FOR REINFORCED CONCRETE PIPE ARCH CULVERTS
(PREFABRICATED)



LONGITUDINAL SECTION



END VIEW



PLAN VIEW

END SECTION DIMENSIONS-INCHES										
SIZE	SPAN	RISE	A	B	C	D	E	T	R	SLOPE
36"	43¾"	26⅝"	11⅛"	60"	36"	96"	72"	4½"	6"	3 To 1
42"	51⅛"	31$\frac{5}{16}$"	15$\frac{13}{16}$	60"	36"	96"	78"	4½"	6"	3 To 1
48"	58½"	36"	21"	60"	36"	96"	84"	5"	6"	3 To 1
60"	73½"	45"	31"	60"	36"	96"	96"	6"	6"	3 To 1
72"	88"	54"	31"	60"	39"	99"	120"	7"	6"	2 To 1

DESIGN OF REINFORCING STEEL & CONCRETE END SECTION SHALL CONFORM TO STANDARD REINFORCED CONCRETE ARCH CULVERTS.

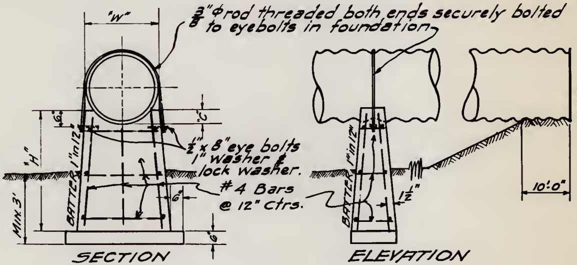
F.E.T.S. TO BE INCLUDED IN LENGTH OF PIPE AS SHOWN ON PLANS.

FOR REINF. CONC. PIPE ARCH. CULVERTS SEE STD. SHEET NO. 52-RC

APPROVED SEPT. 1, 1953
Fred Quinnell Jr.
PRECONSTRUCTION ENGINEER

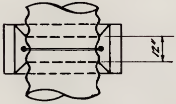
REV. 10-5-53

SUPPORTS FOR CORRUGATED METAL PIPES CARRYING IRRIGATION WATER ACROSS BORROW PITS


"W"
3/8"φ rod threaded both ends securely bolted to eyebolts in foundation
6"
"C"
"H"
Batter 1" in 12"
1/2" x 8" eye bolts 1" washer & lock washer.
#4 Bars @ 12" Ctrs.
6"
Min. 3'
6"
1 1/2"
10'-0"

SECTION

ELEVATION



PLAN

NOTE:- All hardware and reinf steel to be absorbed in the Unit price bid for cu. yd. of concrete.

DIAMETER OF *PIPE	MAX. SPAN OF PIPE C. TO C. OF SUPPORTS	"W"	"C"	CUBIC YARDS CLASS "AD" CONC. IN ONE SUPPORT-FOR DIFFERENT VALUES OF "H"					
				3'	4'	5'	6'	7'	8'
18"	20'	20"	3"	.35	.50	.67	.87	1.10	1.36
24"	18'	24"	4"	.40	.57	.76	.99	1.24	1.54
30"	16'	30"	5"	.48	.67	.90	1.17	1.46	1.80
36"	16'	36"	6"	.55	.78	1.04	1.34	1.68	2.06
42"	14'	42"	7"	.62	.88	1.18	1.52	1.89	2.31
48"	12'	48"	8"	.69	.99	1.32	1.69	2.11	2.57

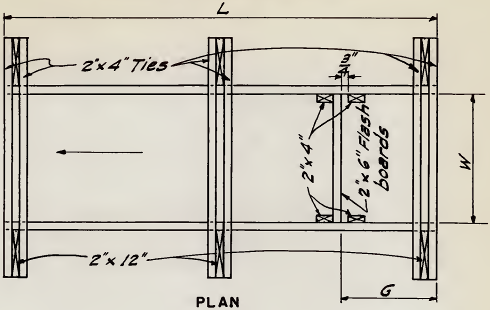
* NOTE: All irrigation pipe to be Syphon Pipe (close riveted and soldered water-tight.)

APPROVED - JAN. 1, 53
CONTROL ENGINEER

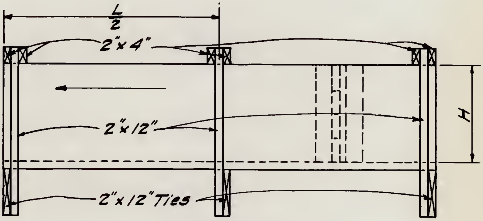
REV. 10-1-51

HG

IRRIGATION DITCH HEAD GATE



PLAN



ELEVATION

Sides & floor to be of 2" matched material.
L = 3 W, but not less than 8'
W. & H. to fit local conditions
G = H
If W is greater than 6', special design to be provided.

NOTE:- Place entrance end of headgate at the point where the high water line in the canal intersects the canal bank. In soils that are easily eroded, it may be necessary to extend the planking in the bottom & sides of the headgate to an intersection with the canal bank.

BILL OF MATERIAL

W=1'-2"	H=2'	180 FBM – (18")
W=1'-8"	H=2'	190 FBM – (24")
W=2'-2"	H=3'	250 FBM – (30")
W=2'-8"	H=3'	270 FBM – (36")

Use 12d. nails. Nails to be included in price bid for lumber.

Montana State Highway Commission.

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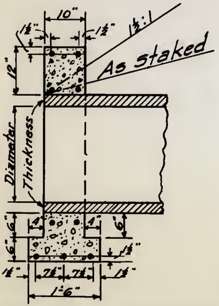
CONTROL ENGINEER

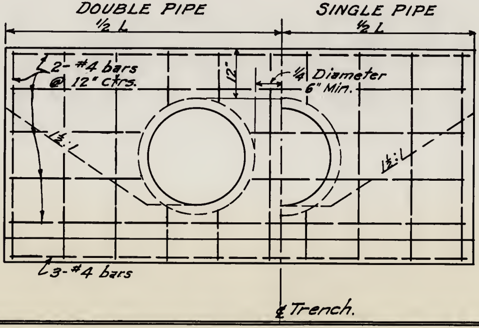
REV. 10-1-51

CUBIC YARDS OF CLASS "AD" CONCRETE

DIAM. OF PIPE	SINGLE CORR. METAL				DOUBLE CORR. METAL				DIAM. OF PIPE	THICKNESS OF SHELL	SINGLE CONC. PIPE				DOUBLE CONC. PIPE			
	AREA SQ. FT. 1 PIPE	L	CU. YDS ONE HDWL	CU. YDS TWO HDWLS	AREA SQ. FT. 2 PIPES	L	CU. YDS ONE HDWL	CU. YDS TWO HDWLS.			OUTSIDE AREA SQ. FT. 1 PIPE	L	CU. YDS. ONE HDWL	CU. YDS TWO HDWLS	OUTSIDE AREA SQ. FT. 2 PIPES	L	CU. YDS. ONE HDWL	CU. YDS. TWO HOWLS
18"	1.767	6'-0"	0.67	1.34	3.534	8'-3"	0.88	1.77	18"	2½"	2.885	6'-0"	0.71	1.42	5.770	8'-8"	0.98	1.95
24"	3.142	8'-0"	0.99	1.98	6.284	11'-0"	1.30	2.60	24"	3"	4.909	8'-0"	1.06	2.12	9.818	11'-6"	1.44	2.87
30"	4.908	10'-0"	1.36	2.72	9.816	13'-9"	1.78	3.55	30"	3½"	7.467	10'-0"	1.46	2.92	14.934	14'-4"	2.10	4.20
36"	7.068	12'-0"	1.78	3.56	14.136	16'-6"	2.32	4.63	36"	4"	10.559	12'-0"	1.92	3.84	21.118	17'-2"	2.56	5.12
42"	9.621	14'-0"	2.25	4.50	19.242	19'-3"	2.91	5.82	42"	4½"	14.186	14'-0"	2.44	4.87	28.372	20'-0"	3.23	6.46
48"	12.566	16'-0"	2.77	5.54	25.132	22'-0"	3.57	7.14	48"	5"	18.348	16'-0"	3.01	6.01	36.696	22'-10"	3.96	7.93
60"	19.635	20'-0"	3.96	7.92	39.270	27'-6"	5.07	10.14	60"	6"	28.274	20'-0"	4.31	8.62	54.548	28'-6"	5.64	11.29

NOTE :- Reinforcing as indicated shall be included in the unit price bid for concrete. Length of bars = L - 6". All exposed edges of concrete to be chamfered 1".





APPROVED - JAN. 1, 53
CONTROL ENGINEER

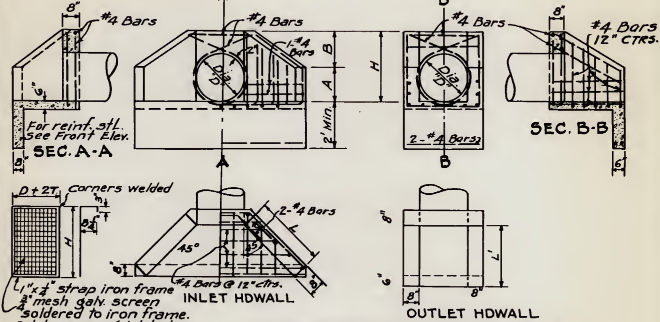
REV. 10-1-51

Montana State Highway Commission.

CONCRETE HEADWALLS FOR PIPE CULVERTS

M6

INLET & OUTLET HEADWALLS FOR C.M.P.



Inlet screen (Not to be used unless recommended by the Eng.) Screen to be absorbed in the unit price bid for Lin. Ft. of pipe.

D = Inside Diam.
T = Thickness of shell

All exposed corners of concrete to be chamfered 1". Reinforcing steel to be not less than 1½" to nearest face of concrete.

INLET & OUTLET HEADWALLS FOR C.M.P.											
CULVERT			CL. AD CONC CU. YDS.		REINF. STL. LBS.		DIMENSION TABLE				
DIA. "D"	AREA SQ.FT.		INLET	OUTLET	INLET	OUTLET	L	L'	A	B	H
18"	1.77		.73	.59	62	50	2'-6"	2'-2"	1'-3"	1'-3"	2'-6"
24"	3.14		.91	.76	82	54	3'-0"	2'-6"	1'-6"	1'-6"	3'-0"
30"	4.91		1.06	.95	99	66	3'-6"	2'-10"	1'-9"	1'-9"	3'-6"
36"	7.07		1.68	1.11	116	82	4'-0"	3'-2"	2'-0"	2'-0"	4'-0"
42"	9.62		2.10	1.40	139	105	4'-6"	3'-6"	2'-3"	2'-3"	4'-6"
48"	12.57		2.32	1.66	162	124	5'-0"	3'-10"	2'-6"	2'-6"	5'-0"

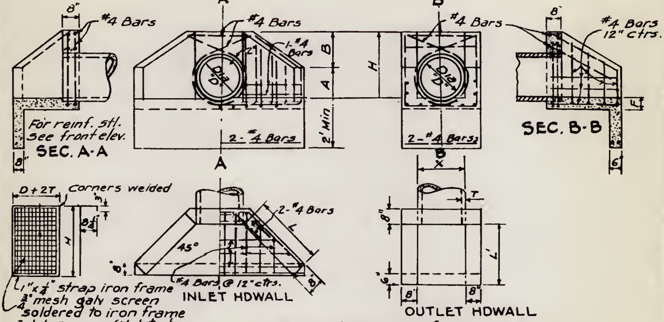
Reinforcing steel as indicated to be included in the unit price bid per cu. yd. of conc.

Montana State Highway Commission

APPROVED - JAN. 1, 53
H. C. Holland
CONTROL ENGINEER

REV. 10-1-51

INLET & OUTLET HEADWALLS FOR R.C.P.



1"x¼" strap iron frame
¾" mesh galv screen soldered to iron frame
Inlet screen (Not to be used unless recommended by the Eng.)
Screen to be absorbed in the unit price bid for Lin. Ft. of pipe

All exposed corners of concrete to be chamfered 1". Reinforcing steel to be not less than 1½" to nearest face of concrete.

INLET & OUTLET HEADWALLS FOR R.C.P.

CULVERT		CL. "AD" CONC. CU. YDS.		REINF. STEEL LBS.		DIMENSION TABLE					
DIA. "D"	AREA SQ. FT.	INLET	OUTLET	INLET	OUTLET	L.	L'	A	B	X	F
18"	1.77	.80	.60	65	53	2'-6"	2'-2"	1'-3"	1'-3"	1'-11"	6½"
24"	3.14	1.00	.86	85	69	3'-0"	2'-6"	1'-6"	1'-6"	2'-6"	7"
30"	4.91	1.42	1.14	104	85	3'-6"	2'-10"	1'-9"	1'-9"	3'-1"	7½"
36"	7.07	1.84	1.43	126	101	4'-0"	3'-2"	2'-0"	2'-0"	3'-8"	8"
42"	9.62	2.12	1.73	150	117	4'-6"	3'-6"	2'-3"	2'-3"	4'-3"	8½"
48"	12.57	2.34	2.07	175	134	5'-0"	3'-10"	2'-6"	2'-6"	4'-10"	9"

Reinforcing steel as indicated to be included in the Unit price bid per cu. yd. of concrete.

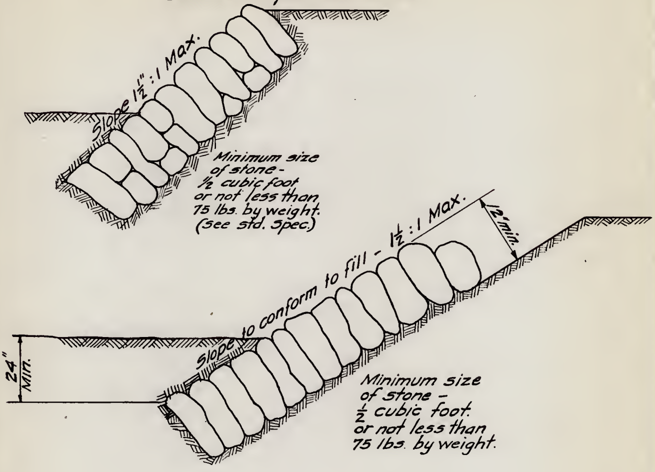
APPROVED - JAN. 1, 53
V. C. Holland
CONTROL ENGINEER

Montana State Highway Commission

REV. 10-1-51

HAND LAID RIPRAP

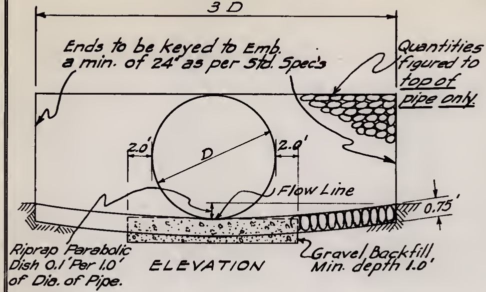
Scale - 3/8" = 1'-0"
See Std. Specifications.


Slope $1\frac{1}{2}$:1 Max.
Minimum size of stone - ½ cubic foot or not less than 75 lbs. by weight. (See std. Spec.)
Slope to conform to fill - $1\frac{1}{2}$:1 Max.
12" min.
24" Min.
Minimum size of stone - $\frac{1}{2}$ cubic foot. or not less than 75 lbs. by weight.

APPROVED - JAN. 1, 53
H. C. Holland
CONTROL ENGINEER

REV. 10-1-51

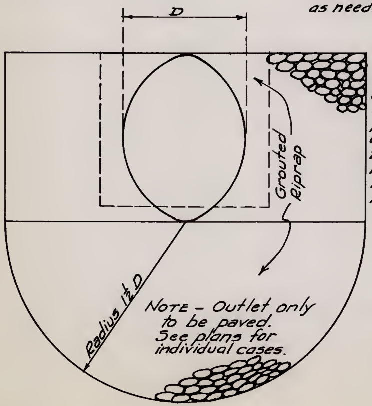
GROUTED RIPRAP HEADWALLS FOR PIPE CULVERTS


3 D
Ends to be keyed to Emb. a min. of 24' as per Std. Spec's
Quantities figured to top of pipe only.
2.0'
D
2.0'
Flow Line
0.75'
Riprap Parabolic Dish 0.1' Per 1.0' of Dia. of Pipe.
ELEVATION
Gravel Backfill, Min. depth 1.0'

QUANTITIES	
DIA. PIPE	S.Y. RIPRAP
84	73.9
90	84.0
96	94.7
102	106.1
108	118.1
114	130.7
120	144.0
126	157.9
132	172.5
138	187.7
144	203.5
150	220.0
156	237.1
162	254.9
168	273.3
174	292.3
180	312.0
210	420.0

NOTE -
D = Dia. of pipe

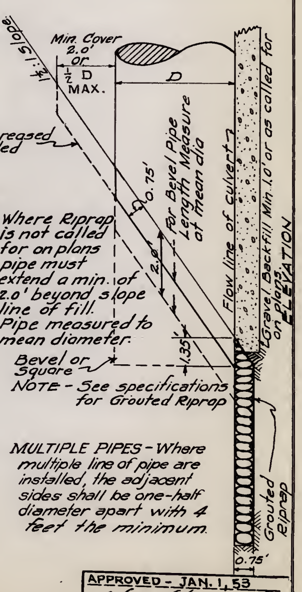
Quantities figured for 2 Hdwalls. & 1 apron for outlet.
Grouted Riprap shall not be placed until the embankment has settled to a stable foundation.



NOTE - Outlet only to be paved. See plans for individual cases.

PLAN

For any size pipe - Area Sq. Yds. to top of pipe only = $1.279906 D^2 + 1.602468 D$ Where D = Dia. of pipe in feet.


1½:1 Slope
Min. Cover 2.0' or ½ D MAX.
D
To be increased as needed
0.75'
2.0'
For Bevel Pipe Length Measure at mean dia
1.35'
Bevel or Square
Flow line of culvert
Gravel Backfill Min. 1.0' or as called for on plans.
ELEVATION
Grouted Riprap
0.75'

Where Riprap is not called for on plans pipe must extend a min. of 2.0' beyond slope line of fill. Pipe measured to mean diameter.

NOTE - See specifications for Grouted Riprap

MULTIPLE PIPES - Where multiple line of pipe are installed, the adjacent sides shall be one-half diameter apart with 4 feet the minimum.

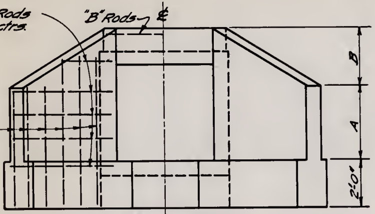
APPROVED - JAN. 1, 53
V. C. Helland
CONTROL ENGINEER

Montana State Highway Commission.

REV. 5-1-48
REV. 10-1-51

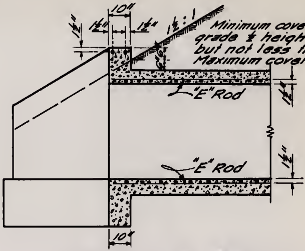
Montana State Highway Commission

REINFORCED CONCRETE BOX CULVERTS



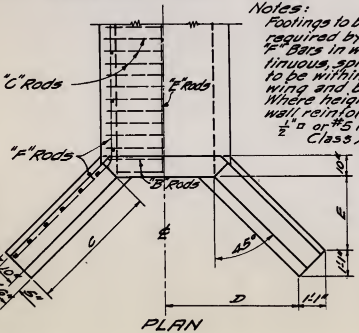
ELEVATION

Minimum length of culvert (out to out of headwall) = crown of roadway plus 4 feet.



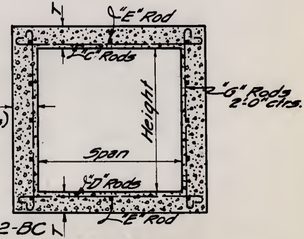
Minimum cover to finish grade ¼ height of box but not less than 1 foot
Maximum cover = 16 feet.

LONGITUDINAL SECTION



PLAN

Notes:
Footings to be carried deeper if required by the Engineer.
"F" Bars in wing and barrel to be continuous, splicing of bars in no case to be within 3'-0" of junction of wing and barrel.
Where height is 2'-0" or less, no wall reinforcing is to be used.
½" □ or #5 rods used throughout (See Plans)
Class "AD" concrete (See Plans)
All exposed corners to be chamfered throughout



CROSS SECTION

For dimensions and quantities see Sheet 112-BC

NOTE:–
Where box is specified to be lengthened see Std. sheet 115-BC

APPROVED - JAN. 1, 53
CONTROL ENGINEER

REV. 10-1-51 REV. 5-1-48
REV. 12-15-49

DIMENSIONS AND QUANTITIES
FOR REINFORCED CONCRETE BOX CULVERTS
WITH WING HEADWALLS

NOTE: Quantities tabulated for reinf. steel in std. are for ½"ø. Increase quantities by 22.7 % for #5 bars

HEIGHT	SPAN	T	W	Headwall Dimensions					BARS IN HEADWALL					BARS IN BARREL							CU.YDS. CONC. IN 2 HDWLS.	LBS. STEEL IN 2 HDWLS.	Barrel per Lin. Ft.	
				A	B	C	D	E	"A" RODS		"B" RODS	"F" RODS		"C" Rods		"D" Rods		"E"	"F"	"G"			CU.YDS. CONC.	LBS. STEEL
									No.	Lgth.	No./Lgth.	No.	Lgth.	Spacing	Lgth.	Spacing	Lgth.	No. 24" ctr.	No. 12" ctr.	Lgth. 24" ctr.				
1'-6"	2'-0"	6"	6"	1'-9"	1'-3"	2'-6"	2'-5¾"	1'-0⅛"	6	3'-6"	2/2'-6"	2/2	2'-0"/2'-6"	9"	2'-9"	12"	2'-9"	2	4	0	2.54	59.5	.167	10.8
1'-6"	3-0	6	6	1-9	1-3	2-6	2-11¾	1-0⅛	6	3-6	2/3-6	2/2	2-0/2-6	8	3-9	11	3-9	2	4	0	2.76	62.9	.204	13.3
1'-6"	4-0	7	6	1-9	1-4	2-8	3-7⅛	1-1½	6	3-6	2/4-6	2/2	2-0/2-8	7	4-9	10	4-9	2	4	0	3.14	66.9	.271	16.7
1'-6"	5-0	8	6	1-9	1-5	2-10	4-2½	1-2⅞	6	3-6	2/5-6	2/2	2-0/2-10	6	5-9	9	5-9	2	4	0	3.52	70.8	.352	21.1
1'-6"	6-0	9	6	1-9	1-6	3-0	4-10	1-4⅜	6	3-6	2/6-6	2/2	2-0/3-0	5	6-9	8	6-9	2	4	0	3.92	74.8	.444	27.2
2'-0"	2-0	6	6	2-0	1-6	3-0	2-10	1-4⅜	8	4-0	2/2-6	2/4	2-6/3-0	9	2-9	12	2-9	2	4	0	3.07	91.8	.185	10.8
2'-0"	3-0	6	6	2-0	1-6	3-0	3-4	1-4⅜	8	4-0	2/3-6	2/4	2-6/3-0	8	3-9	11	3-9	2	4	0	3.29	95.2	.222	13.3
2'-0"	4-0	7	6	2-0	1-7	3-2	3-11½	1-5⅞	8	4-0	2/4-6	2/4	2-6/3-2	7	4-9	10	4-9	2	4	0	3.67	99.7	.290	16.7
2'-0"	5-0	8	6	2-0	1-8	3-4	4-6¾	1-7⅛	8	4-0	2/5-6	2/4	2-6/3-4	6	5-9	9	5-9	2	4	0	4.07	104.3	.370	21.1
2'-0"	6-0	9	6	2-0	1-9	3-6	5-2¼	1-8⅝	8	4-0	2/6-6	2/4	2-6/3-6	5	6-9	8	6-9	2	4	0	4.48	108.8	.463	27.2
3'-0"	3-0	6	7	2-6	2-0	4-0	4-0½	2-0⅞	6/4	4-6/5-6	2/3-6	2/6	2-6/4-0	8	3-11	11	3-11	2	8	3'-9"	4.48	144.5	.284	20.5
3'-0"	4-0	7	7	2-6	2-1	4-2	4-8	2-2⅜	6/4	4-6/5-6	2/4-6	2/6	2-6/4-2	7	4-11	10	4-11	2	8	3-11	4.89	149.6	.353	24.1
3'-0"	5-0	8	7	2-6	2-2	4-4	5-3¼	2-3⅝	6/4	4-6/5-6	2/5-6	2/6	2-6/4-4	6	5-11	9	5-11	4	8	4-1	5.31	154.7	.434	30.5
3-0	6-0	9	7	2-6	2-3	4-6	5-10¾	2-5⅛	6/4	4-6/5-6	2/6-6	2/6	2-6/4-6	5	6-11	8	6-11	4	8	4-3	5.74	159.8	.528	36.8
3-0	7-0	10	7	2-6	2-4	4-8	6-6⅛	2-6½	6/4	4-6/5-6	2/7-6	2/6	2-6/4-8	4	7-11	7	7-11	6	8	4-5	6.20	164.9	.634	47.4
3-0	8-0	11	7	2-6	2-5	4-10	7-1½	2-7⅞	6/4	4-6/5-6	2/8-6	2/6	2-6/4-10	3	8-11	6	8-11	6	8	4-7	6.65	170.0	.752	61.0
4-0	4-0	7	8	3-0	2-7	5-2	5-4⅜	2-10¾	6/6	5-0/6-0	2/4-6	2/8	2-6/5-2	7	5-1	10	5-1	2	10	4-11	6.32	206.3	.428	27.2
4-0	5-0	8	8	3-0	2-8	5-4	5-11¾	3-0⅛	6/6	5-0/6-0	2/5-6	2/8	2-6/5-4	6	6-1	9	6-1	4	10	5-1	6.76	211.9	.510	33.6
4-0	6-0	9	8	3-0	2-9	5-6	6-7⅛	3-1½	6/6	5-0/6-0	2/6-6	2/8	2-6/5-6	5	7-1	8	7-1	4	10	5-3	7.22	217.6	.605	40.0
4-0	7-0	10	8	3-0	2-10	5-8	7-2½	3-2⅞	6/6	5-0/6-0	2/7-6	2/8	2-6/5-8	4	8-1	7	8-1	6	10	5-5	7.68	223.3	.712	59.2
4-0	8-0	11	8	3-0	2-11	5-10	7-10	3-4⅜	6/6	5-0/6-0	2/8-6	2/8	2-6/5-10	3	9-1	6	9-1	6	10	5-7	8.16	228.9	.831	64.5
5-0	5-0	8	9	3-6	3-2	6-4	6-8¼	3-8⅝	8/6	5-6/6-6	2/5-6	2/10	2-6/6-4	6	6-3	9	6-3	4	12	6-1	8.41	276.0	.599	36.7
5-0	6-0	9	9	3-6	3-3	6-6	7-3⅝	3-10	8/6	5-6/6-6	2/6-6	2/10	2-6/6-6	5	7-3	8	7-3	4	12	6-3	8.89	282.2	.694	43.2
5-0	7-0	10	9	3-6	3-4	6-8	7-11⅛	3-11½	8/6	5-6/6-6	2/7-6	2/10	2-6/6-8	4	8-3	7	8-3	6	12	6-5	9.37	288.4	.802	54.0
5-0	8-0	11	9	3-6	3-5	6-10	8-6½	4-0⅞	8/6	5-6/6-6	2/8-6	2/10	2-6/6-10	3	9-3	6	9-3	6	12	6-7	9.86	294.7	.923	67.9
6-0	4-0	7	10	4-0	3-7	7-2	6-9¼	4-3⅝	8/8	6-0/7-0	2/4-6	2/12	2-6/7-2	7	5-5	10	5-5	2	14	6-11	9.76	346.8	.615	33.3
6-0	5-0	8	10	4-0	3-8	7-4	7-4¾	4-5⅛	8/8	6-0/7-0	2/5-6	2/12	2-6/7-4	6	6-5	9	6-5	4	14	7-1	10.25	353.6	.700	39.8
6-0	6-0	9	10	4-0	3-9	7-6	8-0⅛	4-6½	8/8	6-0/7-0	2/6-6	2/12	2-6/7-6	5	7-5	8	7-5	4	14	7-3	10.75	360.4	.797	46.4
6-0	7-0	10	10	4-0	3-10	7-8	8-7½	4-7⅞	8/8	6-0/7-0	2/7-6	2/12	2-6/7-8	4	8-5	7	8-5	6	14	7-5	11.25	367.2	.905	57.3
6-0	8-0	11	10	4-0	3-11	7-10	9-2⅞	4-9¼	8/8	6-0/7-0	2/8-6	2/12	2-6/7-10	3	9-5	6	9-5	6	14	7-7	11.64	374.0	1.027	71.4
7-0	6-0	9	11	4-6	4-3	9-0	9-1	5-7¼	10/10	6-6/8-9	2/6-6	2/14	2-6/9-0	5	7-7	8	7-7	4	16	8-3	13.46	504.0	.910	49.1

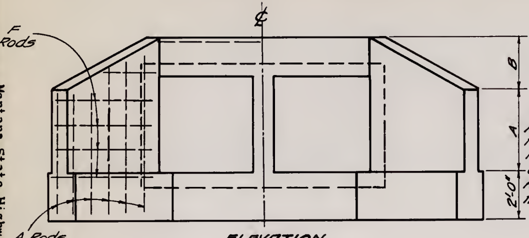
Note-Subtract 10" from Length of barrel for each headwall and multiply by cu. yds. and lbs. per foot.
Quantities for Estimating purposes only.

Montana State Highway Commission

APPROVED - JAN. 1, 53
CONTROL ENGINEER

REV. 12-15-49
REV. 10-1-51

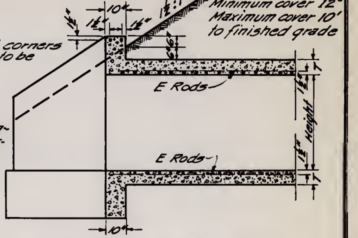
REINFORCED CONCRETE DOUBLE BOX CULVERT



ELEVATION

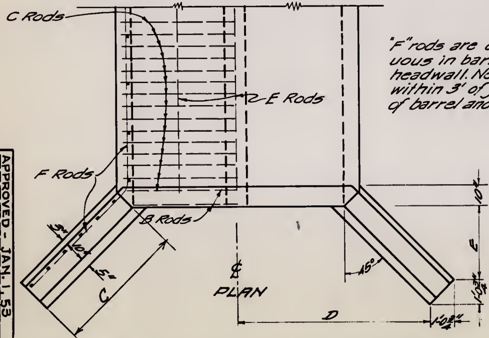
All exposed corners of concrete to be chamfered.

Note:
Headwall foundations to be carried deeper or spread as required by the Engineer



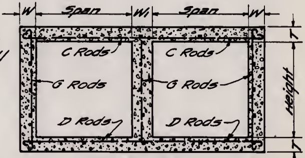
LONGITUDINAL SECTION

NOTE:- LENGTHENING - See Std. 115 BC



PLAN

"F" rods are continuous in barrel and headwall. No splices within 3' of junction of barrel and headwall



CROSS SECTION

Note:
Minimum length of Culvert (out to out of headwalls) = Crown of roadway, plus 4 feet.
Class "AD" concrete (See Plans).
½"□ or #5 rods throughout. (See Plans)
For dimensions and quantities see Std. 114-BC

Montana State Highway Commission.

APPROVED - JAN. 1, 53
CONTROL ENGINEER

REV. 10-1-51
REV. 5-1-48
REV. 12-16-49

C4a

Montana State Highway Commission.

DIMENSIONS AND QUANTITIES FOR REINFORCED CONCRETE DOUBLE BOX CULVERTS WITH WING HEADWALLS

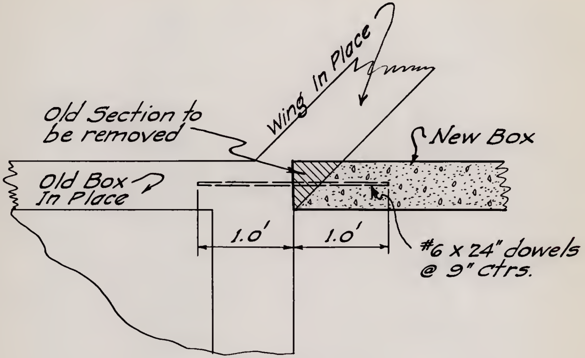
HEIGHT	SPAN	W	W1	T	A	B	C	D	E	BARS IN HEADWALLS						BARS IN BARREL							1 HEADWALL		2 HEADWALLS		BARREL PER LIN. FT.	
										A 12" ctr.		B	F 12" ctr.		G	C		D		E	F	G	CONC. YDS.	STEEL LBS.	CONC. YDS.	STEEL LBS.	CONC. YDS.	STEEL LBS.
										No.	Lgth.	No./Lgth.	No.	Lgth.	No./Lgth.	Spacing	Lgth.	Spacing	Lgth.	No. 24"c	No. 12"c	Lgth. 24"c						
2'-0"	4'-0"	6"	9"	7"	2'-0"	1'-7"	3'-2"	6'-4"	1'-5$\frac{1}{8}$"	8	4'-0"	2/9'-0"	4/2	3'-2"/2'-6"	1/5'-4"	7	9'-6"	10	9-6	7	6	0	2.41	62.1	4.82	124.1	0.548	33.94
2-0	5-0	6	9	8	2-0	1-8	3-4	7-5$\frac{1}{4}$	1-7$\frac{1}{8}$	8	4-0	2/11-0	4/2	3-4/2-6	1/5-4	6	11-6	9	11-6	11	6	0	2.73	66.0	5.47	132.0	0.709	47.48
2-0	6-0	6	9	9	2-0	1-9	3-6	8-6$\frac{3}{4}$	1-8$\frac{5}{8}$	8	4-0	2/13-0	4/2	3-6/2-6	1/5-4	5	13-6	8	13-6	11	6	0	3.07	70.0	6.14	140.0	0.894	58.78
3-0	3-0	7	9	6	2-6	2-0	4-0	5-11	2-0$\frac{7}{8}$	6/4	4-6/5-6	2/7-0	6/2	4-0/2-6	1/6-3	8	7-8	11	7-8	7	8	3'-9"	2.72	83.5	5.43	167.0	0.507	34.35
3-0	4-0	7	9	7	2-6	2-1	4-2	7-0$\frac{1}{2}$	2-2$\frac{3}{8}$	6/4	4-6/5-6	2/9-0	6/2	4-2/2-6	1/6-3	7	9-8	10	9-8	7	8	3-11	3.04	87.8	6.08	175.5	0.643	41.42
3-0	5-0	7	9	8	2-6	2-2	4-4	8-1$\frac{3}{4}$	2-3$\frac{5}{8}$	6/4	4-6/5-6	2/11-0	6/2	4-4/2-6	1/6-3	6	11-8	9	11-8	11	8	4-1	3.37	92.0	6.75	184.0	0.800	54.32
3-0	6-0	7	9	9	2-6	2-3	4-6	9-3$\frac{1}{4}$	2-5$\frac{1}{8}$	6/4	4-6/5-6	2/13-0	6/2	4-6/2-6	1/6-3	5	13-8	8	13-8	11	8	4-3	3.72	96.3	7.44	192.5	0.987	66.87
3-0	7-0	7	9	10	2-6	2-4	4-8	10-4$\frac{5}{8}$	2-6$\frac{1}{2}$	6/4	4-6/5-6	2/15-0	6/2	4-8/2-6	1/6-3	4	15-8	7	15-8	15	8	4-5	4.08	100.5	8.16	201.0	1.195	87.21
3-0	8-0	7	9	11	2-6	2-5	4-10	11-6	2-7$\frac{7}{8}$	6/4	4-6/5-6	2/17-0	6/2	4-10/2-6	1/6-3	3	17-8	6	17-8	15	8	4-7	4.45	104.8	8.90	209.5	1.430	114.77
4-0	4-0	8	10	7	3-0	2-7	5-2	7-9$\frac{3}{8}$	2-10$\frac{3}{4}$	6/6	5-0/6-0	2/9-1	8/2	5-2/2-6	1/7-4	7	9-9	10	9-9	7	10	4-11	3.78	117.2	7.56	234.3	0.762	44.71
4-0	5-0	8	10	8	3-0	2-8	5-4	8-10$\frac{3}{4}$	3-0$\frac{1}{8}$	6/6	5-0/6-0	2/11-1	8/2	5-4/2-6	1/7-4	6	11-9	9	11-9	11	10	5-1	4.13	121.7	8.29	243.4	0.921	57.64
4-0	6-0	8	10	9	3-0	2-9	5-6	10-0$\frac{1}{8}$	3-1$\frac{1}{2}$	6/6	5-0/6-0	2/13-1	8/2	5-6/2-6	1/7-4	5	13-9	8	13-9	11	10	5-3	4.49	126.2	9.01	252.4	1.109	70.23
4-0	7-0	8	10	10	3-0	2-10	5-8	11-1$\frac{1}{2}$	3-2$\frac{7}{8}$	6/6	5-0/6-0	2/15-1	8/2	5-8/2-6	1/7-4	4	15-9	7	15-9	15	10	5-5	4.85	130.8	9.73	261.5	1.319	90.62
4-0	8-0	8	10	11	3-0	2-11	5-10	12-3	3-4$\frac{5}{8}$	6/6	5-0/6-0	2/17-1	8/2	5-10/2-6	1/7-4	3	17-9	6	17-9	15	10	5-7	5.23	135.3	10.50	270.6	1.554	119.62
5-0	5-0	9	12	8	3-6	3-2	6-4	9-8$\frac{1}{4}$	3-8$\frac{5}{8}$	8/6	5-6/6-6	2/11-3	10/2	6-4/2-6	1/8-5	6	12-3	9	12-3	11	12	6-1	5.00	154.9	10.08	309.8	1.079	62.12
5-0	6-0	9	12	9	3-6	3-3	6-6	10-9$\frac{5}{8}$	3-10	8/6	5-6/6-6	2/13-3	10/2	6-6/2-6	1/8-5	5	14-3	8	14-3	11	12	6-3	5.37	159.7	10.82	319.5	1.269	74.95
5-0	7-0	9	12	10	3-6	3-4	6-8	11-11$\frac{1}{8}$	3-11$\frac{1}{2}$	8/6	5-6/6-6	2/15-3	10/2	6-8/2-6	1/8-5	4	16-3	7	16-3	15	12	6-5	5.75	164.5	11.57	329.1	1.483	95.67
5-0	8-0	9	12	11	3-6	3-5	6-10	13-0$\frac{1}{2}$	4-0$\frac{7}{8}$	8/6	5-6/6-6	2/17-3	10/2	6-10/2-6	1/8-5	3	18-3	6	18-3	15	12	6-7	6.23	169.4	12.35	338.7	1.717	123.86
6-0	6-0	9	12	9	4-0	3-9	7-6	11-6$\frac{5}{8}$	4-6$\frac{1}{2}$	8/8	6-0/7-0	2/13-3	12/2	7-6/2-6	1/9-6	5	14-3	8	14-3	12	14	7-3	6.31	199.8	12.74	399.5	1.361	78.90
6-0	7-0	9	12	10	4-0	3-10	7-8	12-7$\frac{1}{2}$	4-7$\frac{7}{8}$	8/8	6-0/7-0	2/15-3	12/2	7-8/2-6	1/9-6	4	16-3	7	16-3	16	14	7-5	6.67	204.9	13.51	409.7	1.576	99.62
6-0	8-0	9	12	11	4-0	3-11	7-10	13-8$\frac{7}{8}$	4-9$\frac{1}{4}$	8/8	6-0/7-0	2/17-3	12/2	7-10/2-6	1/9-6	3	18-3	6	18-3	16	14	7-7	7.10	210.0	14.29	419.9	1.815	127.82

NOTE:- All rods $\frac{1}{2}$"□ or #5 (see Plans). Theoretical weight = 0.85 lbs. per ft. for $\frac{1}{2}$"□ for all computations. No allowance made for splices. Quantities tabulated for reinf. stl. in std. are for $\frac{1}{2}$"□. Increase quantities by 22.7 % for #5 bars
Quantities are for estimating purposes only.

APPROVED - JAN. 1, 53
CONTROL ENGINEER
REV. 12-15-49
REV. 10-1-51

C4a

DETAIL FOR LENGTHENING EXISTING RE-CONC. BOX CULVERT.



Note:- Doweling as shown to be used where top, sides and bottom of new box join that of the old. Curb to be removed if necessary. Dowels to be included in the unit price bid for reinf. steel.

Montana State Highway Commission.

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REV. 10-1-51

116 - S9
117 - S10
118 - S11

REINF. CONC. BOX CULV.

FOR DETAILED PRINTS
WRITE OFFICE ENGINEER
STATE HIGHWAY COMMISSION
HELENA, MONTANA.

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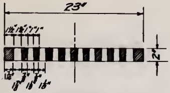
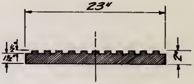
Montana State Highway Commission

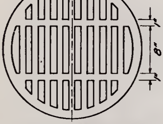
COMBINATION MANHOLE AND CATCH BASIN



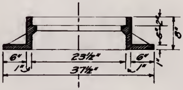
DETAIL
CATCH BASIN COVER



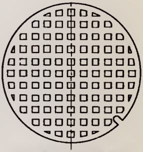
DETAIL
MANHOLE COVER



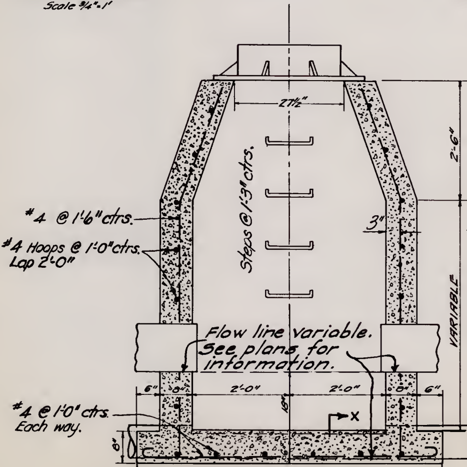
CATCH BASIN COVER
Scale ¾"=1'



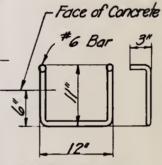
DETAIL
CASTING



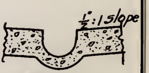
MANHOLE COVER
Scale ¾"=1'


27½"
2'-6"
Steps @ 1'-3" ctrs.
#4 @ 1'-6" ctrs.
#4 Hoops @ 1'-0" ctrs. Lap 2'-0"
3"
VARIABLE
Flow line variable. See plans for information.
6"
8"
2'-0"
2'-0"
8"
6"
18"
X
#4 @ 1'-0" ctrs. Each way.
8"

COMBINATION MANHOLE AND CATCH BASIN
Scale ½"=1'



DETAIL OF STEP
Scale: ¾"=1'-0"



SEC. X-X.

Note: Walls of manhole or catch basin may be of concrete or cement blocks
These details to serve as an example. Designers will design to specific conditions
Use local Standards where available.
All concrete to be Class "AD"

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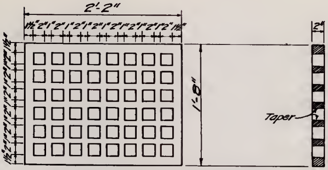
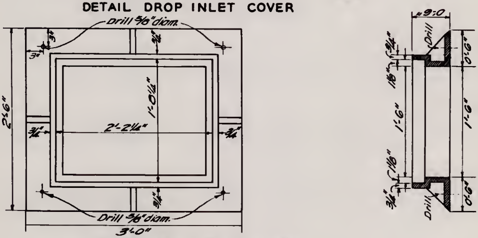
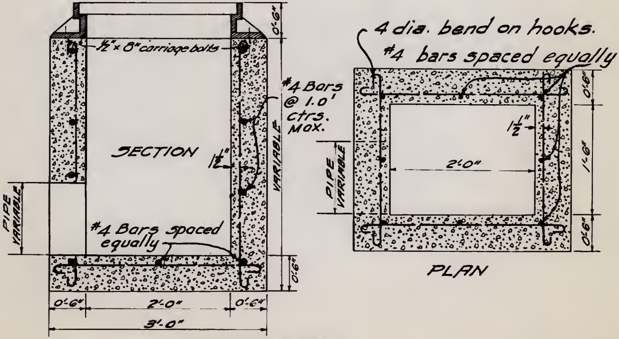
STANDARD DROP INLET



DETAIL DROP INLET COVER



DETAIL DROP INLET FRAME



DROP INLET BOX

NOTE ÷ All concrete to be class "AD"
These details to serve as an example only. Designers will design to fit specific conditions. See Plans for details & quantities.
Use local standards where available.

Montana State Highway Commission.

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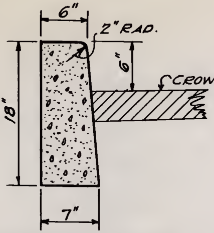
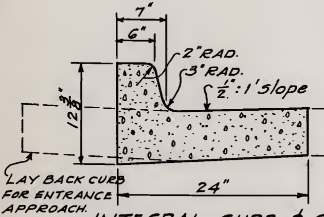
V. C. Holland
CONTROL ENGINEER

REV. 10-1-51

STANDARD CURBS



SEPARATE CURB
0.031 C.Y. CONC. PER 1.0'



INTEGRAL CURB & GUTTER
0.048 C.Y. CONC. PER 1.0'

NOTE :- QUANTITIES SHOWN ABOVE ARE FOR ESTIMATE PURPOSES ONLY.
THE ABOVE DETAILS TO SERVE AS AN EXAMPLE ONLY. DESIGNERS WILL DESIGN TO FIT SPECIFIC CONDITIONS. SEE PLANS FOR DETAILS & QUANTITIES. USE LOCAL STANDARDS WHERE AVAILABLE.

NOTES :-

JOINTS IN CURB :- SEPARATE CURB (WHEN DEFINITELY TIED TO PAVEMENT SLAB), INTEGRAL CURB & GUTTER (WHEN DEFINITELY TIED TO PAVEMENT SLAB) SHALL HAVE THE EXPANSION JOINT OF THE PAVEMENT SLAB EXTENDED THROUGH & SHALL HAVE A $\frac{1}{2}$" TYPE "A" PREMOLDED BIT. EXPANSION JOINT AT EVERY CONTRACTION JOINT.

SEPARATE CURB (WHEN NOT DEFINITELY TIED TO PAV. SLAB) SHALL BE DIVIDED INTO SEPARATE BLOCKS 10' LONG BY NO. 18 GA. PLATES CUT TO THE EXACT CROSS SEC. OF THE CURB, AND SHALL HAVE 1" TYPE "A" PREMOLDED BIT. EXPANSION JOINTS AT 35' INTERVALS AND AT THE END OF ALL CURB RETURNS. A $\frac{1}{2}$" PREMOLDED BIT. EXP. JOINT SHALL BE PLACED BETW. THE CURB & THE PAV. SLAB

WHERE CURB ABUTS SIDEWALK OR ANY SOLD STRUCTURE A 1" PREMOLDED BIT. EXP. JOINT SHALL BE USED.

MIN. CURB RETURN RADII - STREETS & ALLEYS - 5'
PRIVATE DRIVEWAY - 3'
15' RADII DESIRABLE FOR STREETS & ALLEYS.

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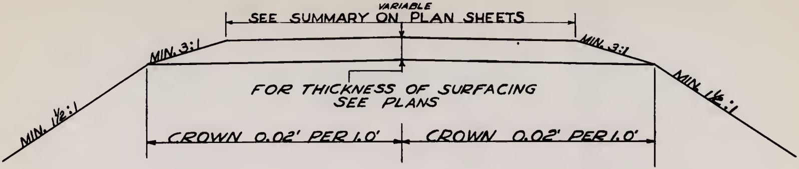
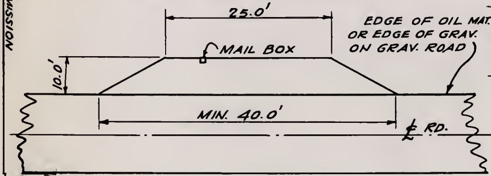
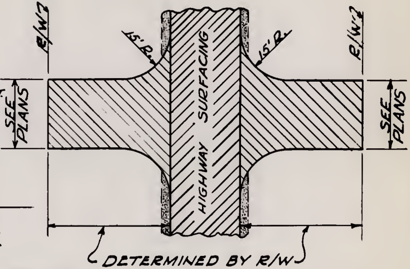
SURFACING FOR BRIDGES & APPROACHES



NOTE:- FOR ADDITIONAL INFORMATION & QUANTITIES SEE PLANS

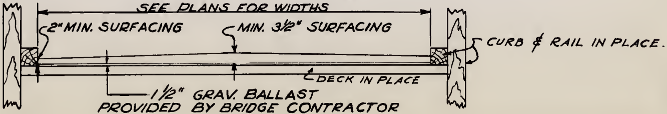
MAIL BOX TURNOUT





SURFACE FOR BRIDGE

NOTE:- FOR ADDITIONAL INFORMATION & QUANTITIES SEE PLANS



MONTANA STATE HIGHWAY COMMISSION

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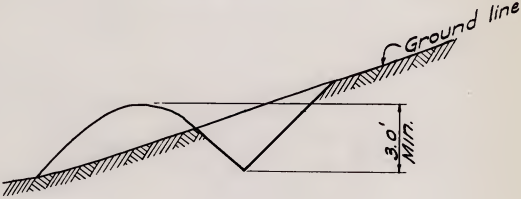
REV. 10-1-51

141
RA1

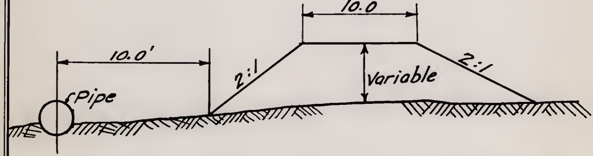
FURROW DITCH & DITCH BLOCK

FURROW DITCH



Exc. approx. 15 cu. yds. per station.

DITCH BLOCK



Note:- keep top of ditch block at least 1.0 ft. below finished shoulder elevation and toe of slope flow 10.0' from pipe.

Montana State Highway Commission.

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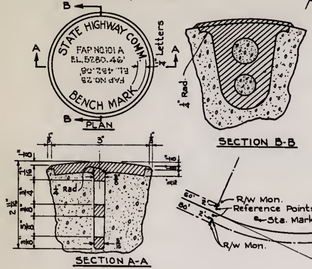
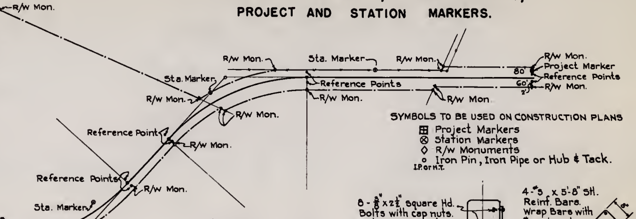
REV. 10-1-51

RIGHT OF WAY MONUMENTS, REFERENCE POINTS, PROJECT AND STATION MARKERS.

BRONZE TABLET

To be set in top of project marker.





SYMBOLS TO BE USED ON CONSTRUCTION PLANS

- ⊞ Project Markers
- ⊗ Station Markers
- ◇ R/W Monuments
- ○ Iron Pin, Iron Pipe or Hub & Tack. I.P. or H.T.

GENERAL:- Reference points, Project and Station markers should be so placed that they will not be disturbed by maintenance operations. Project and Station markers should be plainly visible from the highway.

PROJECT MARKERS are to be set at the beginning & end of all projects on either side of the highway.

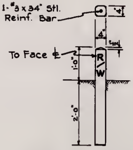
REFERENCE POINTS are to be set on both sides of the ℄ at the beginning & end of all projects, at all PCs, PTs and angle points and at such high points on long tangents as may be desirable. Except at project markers, they are to be at any convenient distance from the ℄.
After being driven a cross will be filed in the top to mark both the plus and the distance to the ℄.

STATION MARKERS are to be set opposite every tenth station and at important equations. Equations of less than 100' may be disregarded. Markers are to be set on the north or west side of the ℄ depending on the general direction of the route or shall be set so as to be visible from highway ℄. (on R/W line if possible).

RIGHT OF WAY MONUMENTS will be set at all points where the width of the R/W changes. and at PCs, PTs and at angle points. When it seems undesirable to use the concrete monuments as on lot or block lines in some parts of a town, concrete monuments will be omitted & iron pipes or pins will be placed by State Highway Commission forces.

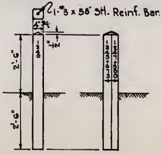
BRONZE TABLET. Exposed surfaces of the tablet are to be ground smooth. Letters are to be recessed $\frac{1}{16}$ inch. Information on the tablet, indicated by pin lines, is to be stamped in the field by the engineering party after post is placed using $\frac{3}{16}$" letters.

NOTE:- R/W monuments not to be ordered by contractor until checked in field by the Engineer.
R/W monuments to be placed so that outside face of monument coincides with R/W line as purchased.



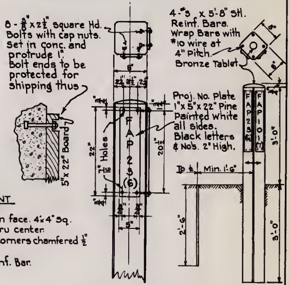
RIGHT OF WAY MONUMENT

¾" Max. Size Aggregate
Class "D" Conc. Rubbed finish on face. 4"x4" Sq.
#3 x 34" Stl. reinforcing bar thru center.
Recessed letters 3" high. Corners chamfered ½"



STATION MARKERS

¾" Max. Size Aggregate
Class "D" Conc. Rubbed finish on face. 4"x4" Sq.
Recessed letters 1½" high.


8 - ⅜"x 2½" square Hd. Bolts with cap nuts. Set in conc. and protrude 1". Bolt ends to be protected for shipping thus
5"x 22" Board
4-#3 x 5'-8" Stl. Reinf. Bars. Wrap Bars with #10 wire at 4" Pitch.
Bronze Tablet
8"
Proj. No. Plate 1"x 5"x 22" Pine Painted white all sides. Black letters & No's. 2" High.
$\frac{7}{16}$" Holes
22"
20½"
5"
F A P 2 3 (6)
F A P 1 0 1 (7)
To ℄
Min. 1'-6"
2'-6"
3'-0"
3'-0"

PROJECT MARKER

Posts to be reinf. concrete
Aggregate ¾ inch max.
Class "D" Concrete.
Corners chamfered ½".
Project number plate to be furnished & erected by State Forces.
Series "D" letters & numerals to be used as per Std. alphabets published by Public Rds. Adm. 1945.

REFERENCE POINT

1" Iron pin.
Another reference point to be set on opposite side of hwy.

Montana State Highway Commission.

APPROVED - JAN. 1, 53
H. C. Holland
CONTROL ENGINEER

REV. 6-1-48 REV. 10-1-51
REV. 1-27-47

M1 161

171
SN

STANDARD SUMMARY NOTES

GRADES	For relation of profile grade to sub-grade see typical section.
EMBANKMENT	Quantities shown on plans include shrinkage, unless otherwise noted.
SHRINKAGE	See Std. 242-SF & 243-SF1
BORROW	Borrow pits or source of borrow shown on plans, or as designated by Engr.
OVERHAUL	Free haul limit is 1000' feet.
EXCESS	Excess to be disposed of as directed by the Engineer.
WIDENING	See Std. 231-G5
SUPERELEVATION	See Std. 231-G5
PROJECTIONS	All projections to be checked in field with reference to the staked line.

Montana State Highway Commission.

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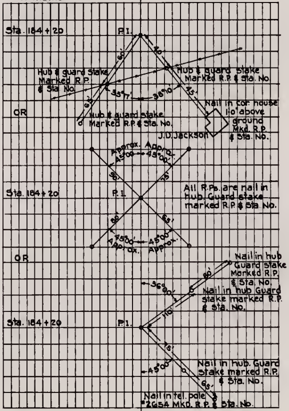
REV. 10-1-51

STANDARD LOCATION TRANSIT NOTES

Station	Point	Defl.	Δ	M. C.	C. C.
EQUATION				S.06°05'E.	S 26°00'E.
187+19.5 AHEAD = 185+20.5 BACK	P.T.	10°05'			
185+00		9°34'			
184+20	P.I.		Δ=20°10' RT.		
			D=5°		
184+00		7°04'	T=203.8'		
			L=403.3'		
183+00		4°34'	R=1146.0'		
182+00		2°04'			
181+17.2	P.C.	0°00'			
				S46°10'E.	S26° 15'E.
				P.I. to P.I. 715.0'	
176+00	P.O.T.				

Johnson - Inst.
Rogers - Chain
Williams

6-16-21 16
Cloudy - Warm


Sta. 184+20
P.I.
60'
70'
Hub & guard stake Marked R.P. & Sta. No.
Hub & guard stake Marked R.P. & Sta. No.
35°17'
38°10'
45'
65'
OR
Hub & guard stake Marked R.P. & Sta. No.
Nail in cor. house 1.0' above ground Mkd. R.P. & Sta. No.
J.D. Jackson
Approx. 45°00'
Approx. 45°00'
30'
75'
Sta. 184+20
P.I.
All R.Ps. are nail in hub. Guard stake marked R.P. & Sta. No.
80'
65'
45°00' Approx.
45°00' Approx.
OR
Nail in hub Guard stake Marked R.P. & Sta. No.
80'
36°00'
Nail in hub Guard stake marked R.P. & Sta. No.
110'
Sta. 184+20
P.I.
75'
45°00'
Nail in hub. Guard stake marked R.P. & Sta. No.
65'
Nail in tel. pole #2654 MKD. R.P. & Sta. No.

Reference Points must be firmly set and well marked so as to be easily found.

Run all curves from Harger and Bonney data.

Show detail data in proper column, how curve was staked in field.

Use sufficient space to make notes clear and distinct without crowding.

Curves may be located by deflection angles or tangent offsets.

When the deflection angle is 30° or greater the P.I. may be referenced by two R.Ps. on the back tangent produced ahead or the new tangent produced back. Measure distances to R.Ps.

Show relationship between bearings of survey & bearings of adjoining projects.

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CONTROL ENGINEER

Montana State Highway Commission

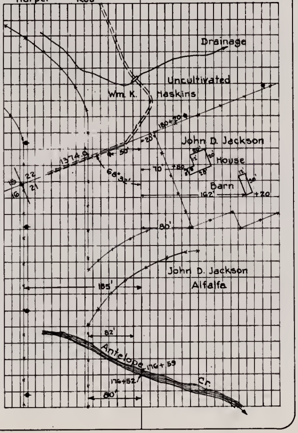
STANDARD TOPOGRAPHY NOTES

Station	Designation	Classification
182 + 00		
+ 10	36" x 28' C.M. Pipe (Poor) 2 - M6 Hdwlls (Poor).	
181 + 00	Drain in place - Remove	
	New 48" x	
+ 40	Old road	
+ 20	Section line	
180 + 00		10 % Rock
179 + 00		
178 + 00		
177 + 00		
+ 59	Top of bank	
+ 55	Creek bed	
+ 52	Top of bank	
176 + 00		

Johnson - Inst.
Rogers - Chain
Williams -
Harper - Rod

6 - 24 - 41
Cloudy - Warm

12



Where ties to section lines are made on a curve, same must be taken to semi-tangent and to circular curve.

Designate all structures, both in place and proposed. Irrigation or drainage. Show direction of flow.

For structures in place, be sure to give sizes, type & condition.

In land use, give cultivated, swamp or grazing.

Sketch all topography using direct & ties in feet. Pole lines to be identified as to kind, owner, & no. on poles, no. of wires & clearance. Wherever line crosses proposed center line. (Clearance is to the lowest wire). Station & Angle. On Power lines - give voltage.

On Bridge survey sheets fill in all requested data.

Classification can be covered by giving the percentage of rock.

Locate all springs.

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CONTROL ENGINEER

202
N2

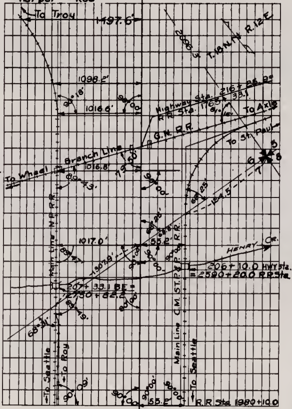
REV. 1-30-52

STANDARD TOPOGRAPHY NOTES (RAILROAD)

Station	Designation	Classification
224+00.0		
220+00.0		
218+09.0		
215+00.0		
214+67.3	= 2768+16.4 N.P. R.R. Sta = 1436+83.2 G.N. R.R. Sta.	
210+00.0	= 2765+49.1 R.R. Sta.	
C.M. St. P. & P.	75' Untr. Tbr. Pile Bridge	On R.R. Rt.
N.P. R.R.	66.3' Treated Tbr. Pile Bridge	On R.R. Lt.
205+00.0		
200+00.0	1017.9' Between ℄'s Highway &	R.R. Lt.

Johnson - Inst.
Rodgers - Chain
Williams -
Harper - Rod

6-24-41 13
Cloudy - Warm



Bridges on R.R. - Give length, water way area, type of bridge, Elevation top of rail, profile of stream or flow line from R.R. to Hwy. ℄, X-Sec. of that area.

Locate all R.R drainage structures, give sizes & Elev. of flow line.

Show all rivers, creeks & Irr. Dts.

Make at least two transit ties on each railway tangent on R.R. ℄ within 400' of any Hwy. ℄.

Make sufficient transit ties on curves so that the ℄'s can be accurately plotted.

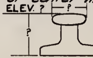
Give equivalent stationing of Hwy. to Ry. either by tying to a permanent Ry culvert, bridge or stationing marker; or by measuring distance along track from transit tie to permanent Ry. culvert or bridge.

At every location where Ry. & Hwy. are within 400' of each other, extend not less than two X-section from Hwy. ℄ across Ry. Emb.

When Hwy. is located along Ry. for considerable distance extend X-section across Ry. Emb. at Max. intervals of 1,000'.

Note the location of Ry. telephone or telegraph or power poles and number of wires, if between Hwy. and Ry., tie in with survey data.

Where Ry. crosses Hwy. show Hwy. Sta. & R.R. Sta., angle and on Ry. curve show chord Min. of 200' each side of center line.



Give Rail Dimensions.

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STANDARD CROSS SECTION AND LEVEL NOTES

Station	+ B.S.	H.I.	− F.S.	Profile Rod Read.	Elev.	Jones - Inst. Harper - Rod	6-20-41 Clear - Warm	17
175+80		3642.54		0.67	3641.9'	Top S. rail - N.P. RY.		
176+00				3.6	38.9	2.5/30, 3.2/15, 3.6/0	3.8/30, N. bk. Cr. 2.2/140, W.S. 5.6, ¢ Ch. 7.6/152, H.W. 4.0/159, S. bk. Cr. 2.1/160	
+50				3.8	38.7	1.3/50, 2.5/30, 3.4/18, 3.8/0	10.5/3, 12.7/10, 10.3/17, 4.2/20, 4.5/30	
+52				11.6	30.9	2.1/50, 2.5/30, 2.7/3, 11.6/0	12.5/8, 10.4/17, 2.9/19, 3.2/30	
Creek Fall +57				11.6	30.9	9.6/300, 10.9/200, 11.2/100, 11.4/50, 11.4/25, 11.5/15, 11.6/0	11.7/30, 11.8/50, 11.9/100, 12.3/200, 12.2/300	
+59				11.5	31.0	2.8/50, 3.2/30, 3.5/18, 11.5/15, 12.3/7, 11.5/0	9.3/3, 8.6/6, 4.0/30	
+60				2.9	39.6	2.2/50, 2.5/30, 8.7/26, 11.7/20, 9.5/3, 2.9/0	3.3/30, 4.0/60	
177+00				0.4	42.1	N. bk. Cr. 2.2/100, H.W. 4.0/97, ¢ Ch. 5.6/95, W.S. 4.5, S. bk. Cr. 2.1/80, 0.2/10, 0.4/0	0.6/15, 1.3/30, 1.8/50	
T.P.	10.46	3652.80	0.20		42.34			
178+00				6.6	46.2	4.1/30, 3.6/8, 6.6/0	2.0/20, 2.3/30	
179+00				6.4	46.4	5.5/20, 6.4/4, 6.4/0	2.0/20, 2.3/30	
180+00				2.5	50.3	1.4/30, 2.5/0	3.4/25, 1.0/30	
B.M. #7				0.76	3652.04	S.E. Cor R.R. bridge abut. Top marked ⊗ 80' Lt. Sta. 180+40		
+50				0.32	3652.5'	Top S rail N.P.RY.		

NOTE - Leave 3 to 4 spaces betw. readings

Tie Bench levels into any adjoining projects.

Show Equa. in levels Beg. or End of project.

Take levels in creek beds sufficiently far from both sides of ¢ of creek to locate any proposed channel changes.

Take "base of rail" elevations every 500 ft. where ¢ parallels a railway. Extend X-sections to cover same.

Note all equations in column marked "Station" as shown in transit notes.

Give description of all B.M.'s. and location.

Take wide sections 200' or more when req'd. for high fills, deep cuts, channel changes, interception ditches, wide borrow pits, etc.

Note all flow line elevations - both stream and irrigation ditches. Note High water elev's. at critical points if possible.

Take Rod readings to nearest 0.1' with the exception of existing city pavements which should be taken to nearest 0.01'.

Cross section elevations when computed will be written immediately above rod reading as

39.3
3.2/15

Tie all B.Ms. to U.S.G.S. or U.S.C.& G.S. where possible.

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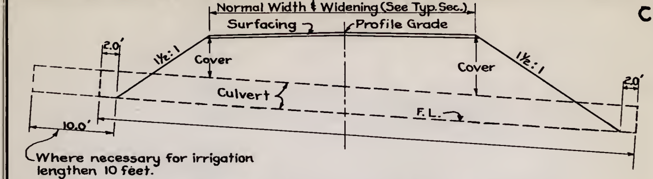
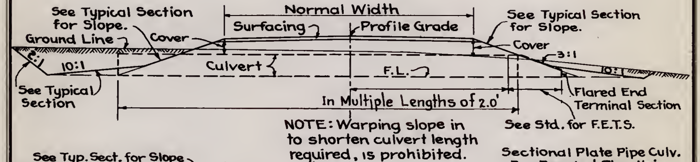
204
N3

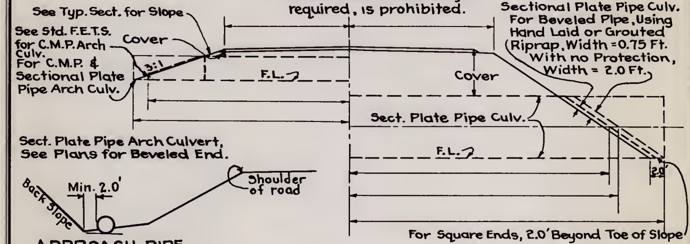
STANDARD METHOD OF DETERMINING CULVERT LENGTHS

C1


Normal Width & Widening (See Typ. Sec.)
Surfacing
Profile Grade
2.0'
1½:1
Cover
Cover
1½:1
2.0'
Culvert
F.L.
10.0'
Where necessary for irrigation lengthen 10 feet.

NOTE: Corrugated metal pipe (C.M.P.) is made in multiple lengths of 2'.
Concrete pipe is made in multiple lengths of 2.'


See Typical Section for Slope.
Normal Width
See Typical Section for Slope.
Surfacing
Profile Grade
Ground Line
Cover
Cover
2:1
10:1
Culvert
F.L.
3:1
10:1
See Typical Section
In Multiple Lengths of 2.0'
Flared End Terminal Section
See Std. for F.E.T.S.
NOTE: Warping slope in to shorten culvert length required, is prohibited.


See Typ. Sect. for Slope
See Std. F.E.T.S. for C.M.P. Arch Culv.
For C.M.P. & Sectional Plate Pipe Arch Culv.
Cover
3:1
F.L.
Cover
Sectional Plate Pipe Culv. For Beveled Pipe, Using Hand Laid or Grouted Riprap, Width = 0.75 Ft. With no Protection, Width = 2.0 Ft.
Sect. Plate Pipe Culv.
F.L.
Sect. Plate Pipe Arch Culvert, See Plans for Beveled End.
2.0'
Back Slope
Min. 2.0'
Shoulder of road
For Square Ends, 2.0' Beyond Toe of Slope

APPROACH PIPE

F.L. = Flow line of culvert on ℄. (Note on cross-section.)

Draw in culvert outline solid at the proper cross-section station or nearest cross-section to it. Keep in mind that skewing the culvert will increase the length of culvert required. Place culvert low enough to drain borrow pits.

Irrigation pipe to be carried across borrow pits to a minimum of 10.0 feet bearing beyond edge of borrow. Channel changing irrigation ditch to obtain right angle crossing is prohibited unless specifically recommended.

Where fall of the ground permits proper drainage, pipe culverts are to be trenched into the natural ground to a depth of ⅓ the diameter of the pipe.

Flared end terminal sections included in total Lin. Ft for pipe.

Spacing of multiple regular full round pipes – The clearance between adjacent pipes should be a minimum of 5' or ½ Dia. of pipe.

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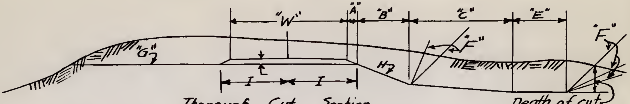
TEMPLATING STANDARDS



Thorough Cut Section

W=Normal width of roadway at finish grade.
A=Distance for total surfacing.
B=Variable Width of slope.
C=Variable width of borrow ditch on a 10:1 slope with a maximum distance of 20.0'. As needed for borrow, drainage, & snow conditions. Widening borrow ditch for snow conditions the prevailing winds should be checked for each project.

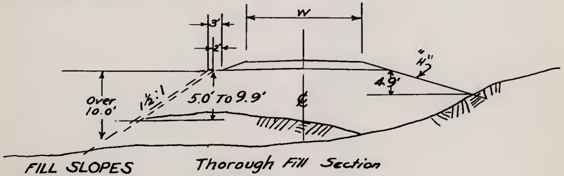
E=Any additional borrow pit width required beyond the 10:1 slope 20.0' distance shall be a 0.0.

F= Solid rock cut slopes will vary from ¼:1 min. to 1:1 max.
Other cuts use the following back slopes.
1:1 Slope For Cuts Over 20.0' depth,
2:1 " " " Betw. 10.0' & 20.0'
3:1 " " " " 3.0' & 10.0'
5:1 " " " of 3.0' or Less

Backslopes to be uniform through each individual cut.

G= Daylight section should be carried on 10:1 grade from the bottom of the surfacing or top of Sub-Grade where possible.

H= Inslope will vary, 3:1, 4:1, 5:1, & 10:1.
I = Use 0.02' per 1.0' for crown.



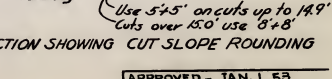
FILL SLOPES Thorough Fill Section

Use "H" Slopes for Fills 5.0' or less
Use 1½:1 Slopes for Fills Betw. 5.0' & 10.0' & Widen 2.0'
Use 1½:1 Slopes for Fills over 10.0' & widen 3.0'

Refer to Standards for widening & superelevation for curves.

Note:- The above information can be used for most designs, however, revisions can be made to fit specific conditions. It is recommended that where ever necessary furrow ditches be carried on uphill side of roadway prism to collect & carry water to drains and prevent erosion of back slopes.

Note:- With the exception of rock material, all 1:1 to 3:1 back slopes Inc. to be rounded.



SECTION SHOWING CUT SLOPE ROUNDING

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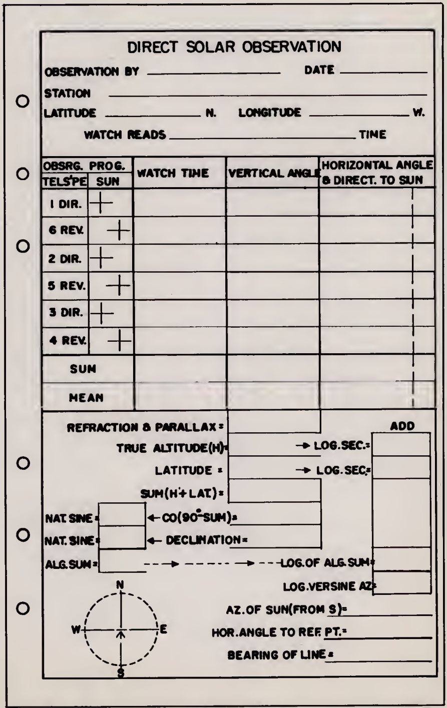
REV. 10-1-51

SOLAR OBSERVATION



DIRECT SOLAR OBSERVATION

OBSERVATION BY ____________ DATE ________
STATION ____________
LATITUDE ________ N. LONGITUDE ________ W.
WATCH READS ____________ TIME

OBSRG. PROG.		WATCH TIME	VERTICAL ANGLE	HORIZONTAL ANGLE & DIRECT. TO SUN
TELS'PE	SUN			
I DIR.	+			
6 REV.	+			
2 DIR.	+			
5 REV.	+			
3 DIR.	+			
4 REV.	+			
SUN				
MEAN				

REFRACTION & PARALLAX =
ADD
TRUE ALTITUDE(H) = → LOG.SEC. =
LATITUDE = → LOG.SEC. =
SUM(H + LAT.) =
NAT. SINE = ← CO(90°-SUM) =
NAT. SINE = ← DECLINATION =
ALG. SUM = ---→ -----→ --- LOG. OF ALG. SUM =
LOG. VERSINE AZ =
AZ. OF SUN(FROM S) = ________
HOR. ANGLE TO REF. PT. = ________
BEARING OF LINE = ________

NOTE:- ANY OTHER SUITABLE FORM MAY BE USED.

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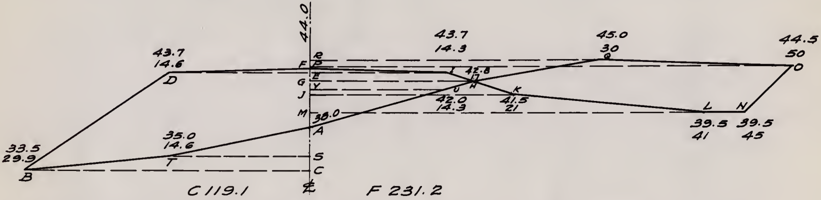
REV. 1-28-52

STANDARD FOR STAKING NOTES & COMPUTING END AREAS

Sta.	Sub-Grade +	Hi.	Grade Rod	Super −	Elevation Shoulders Lt. Rt.	Rotchford - Inst. Iseminger - Rod Dorrington - Tape Jones - Axe 6/15/37 Clear-Warm
B.M.	9.16	46.00			2036.84	Spike in 12" Tamarack 60' Lt. of Sta. 580+60
						32.2 33.5 35.0 38.0 42.0 42.8 45.0 44.5 44.7
						-10.2 -8.7 -6.0 -1.7 -0.9 C5.0 C0.7
584	44.00		2.0		℄	13.8 12.5 11.0 8.0 4.0 3.2 1.0 1.5 1.3
			2.3 2.3		14.6 14.3	35 29.9 14.6 14.3 17 30 50 60
			4.5		21	
			6.5		41-45	



C 119.1 ℄ F 231.2

The starting point is determined as follows:-

A. Where the area crosses center-line, start with the lower of the two center-line points.

B. Where the area does not cross center line, start with the naught naught point closest to center line.

In going around the areas, proceed counter clockwise on the right of center-line & clockwise on the left.

This method deals entirely with triangles & trapezoids, the horizontal distances forming the bases & the vertical distances forming the altitudes. One side of each triangle or trapezoid is formed by a vertical distance (altitude) on center-line. The altitude is found by subtracting the elevations involved in going from one point to another. The horizontal distances are read direct, the altitude being multiplied by each of the two. In going from a higher point to a lower point the triangle or trapezoid is a minus quantity & vice versa the quantity is plus. When one of the two points is on center-line the figure is a triangle, otherwise it is a trapezoid. The formula for computing the area of any triangle or trapezoid is the altitude multiplied by the base or sum of the bases divided by two. This division is done last.

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CUT AREA

(42.8-41.5)x(17.0+21.0) = 1.3 x 38.0 = -49.40
area of trapezoid GJKH
(41.5-39.5)x(21.0+41.0) = 2.0 x 62.0 = -124.00
area of trapezoid JMLK
(44.5-39.5)x(45.0+50.0) = 5.0 x 95.0 = +475.00
area of trapezoid PMNO
(45.0-44.5)x(50.0+30.0) = 0.5 x 80.0 = +40.00
area of trapezoid RPOQ
(45.0-42.8)x(30.0+17.0) = 2.2 x 47.0 = -103.40
area of trapezoid RGHQ

Total Quantities +515.00
Total Quantities -276.80
238.20
238.20 ÷ 2 = 119.10 square feet
Cut area of figure HKLNOQ

FILL AREA

(Left of center line).
(38.0-35.0)x(00.0+14.6) = 3.0 x 14.6 = -43.80
area of triangle AST
(35.0-33.5)x(14.6+29.9) = 1.5 x 44.5 = -66.75
area of trapezoid SCBT
(43.7-33.5)x(29.9+14.6) = 10.2 x 44.5 = +453.90
area of trapezoid ECBD
(44.0-43.7)x(14.6+00.0) = 0.3 x 14.6 = +4.38
area of triangle FED
(Right of center line).
(42.0-38.0)x(00.0+14.3) = 4.0 x 14.3 = +57.20
area of triangle VAU
(42.8-42.0)x(14.3+17.0) = 0.8 x 31.3 = +25.04
area of trapezoid GVUH
(43.7-42.8)x(17.0+14.3) = 0.9 x 31.3 = +28.17
area of trapezoid EGHI
(44.0-43.7)x(14.3+00.0) = 0.3 x 14.3 = +4.29
area of triangle FEI
Total Quantities +572.98
Total Quantities -110.55
462.43
462.43 ÷ 2 = 231.215 square feet
Fill area of figure ATBDFIHU

CALCULATOR MACHINE METHOD COMPUTED WITH AN EIGHT ROW KEYBOARD

(All dials and the rows on the keyboard are numbered from the right to the left)

Turn into the upper dials 3 to 1 the elevation of the starting point as previously determined. In computing the area of the fill (ATBDFIHU) this figure would be 38.0. Establish two decimal points on the keyboard for the distances. In this instance the decimal points would be between rows 2 and 1 and between rows 7 and 6. Then the decimal points on the lower dials would be between dials 3 and 2 and between dials 8 and 7. The fill area either left or right of center-line can now be computed.

1. Starting on the left and proceeding clockwise, set the distance 14.6 around one of the keyboard decimals, say the one on the left side of the machine. Keyboard reads 14.60000.0. Change upper dials to read 35.0, the elevation at 14.6. Lower dials read (dials 11 to 1) 9956.20000.00 and the area of the triangle AST has been subtracted, always bearing in mind the fact that the final answer will be divided by 2.

2. Set 29.9 around the decimal point established on the right of the keyboard. Keyboard reads 14.60029.9. Change upper dials to read 33.5, the elevation at 29.9. Lower dials read (dials 11 to 1)

9934.29955.15 and the area of the trapezoid SCBT has been subtracted.

3. The next clockwise point is at 14.6 which is the number on the left of the machine. Therefore there is no change in the keyboard and it still reads 14.60029.9. Change upper dials to read 43.7, the elevation at 14.6 on the typical section or templet. Lower dials read (dials 10 to 1) 083.22260.13 and the area of the trapezoid ECBD has been added. It may be that a 1 or a 9 will appear in lower dial 12 or 13, depending upon the type of machine used or the manner in which the elevation 33.5 is changed to 43.7, but in any event disregard it.

Note: It is now obvious that the distances placed on the keyboard alternate from the left to the right of the keyboard, and that every distance is multiplied by the difference in elevation involved in going from one point to another. Therefore each distance is always multiplied by two figures, one when going to the distance and one when leaving the distance.

4. The next point is at center-line. Therefore clear the right side of the keyboard. Keyboard reads 14.60000.0. Change upper dials to read 44.0, the elevation at 0.0. Lower dials read (dials 10 to 1) 087.60260.13 and the triangle FED has been added.

5. Clear the left side of the keyboard. Keyboard reads 00.00000.0. Change upper dials to read 38.0. Lower dials will not change and the area to the right of center-line can now be computed.

6. Proceeding counter clockwise, set 14.3 on the left side of the keyboard. Keyboard reads 14.30000.0. Change upper dials to 42.0. Lower dials read 144.80260.13 and the triangle VAU has been added.

7. Set 17.0 on the right side of the keyboard. Keyboard reads 14.30017.0. Change upper dials to read 42.8. Lower dials read 156.24273.73 and the trapezoid GVUH has been added.

8. The next counter-clockwise point is at 14.3, so the keyboard reading remains 14.30017.0. Change upper dials to 43.7, lower dials read 169.11289.03, and the trapezoid EGHI has been added.

9. Clear the right side of the keyboard. Keyboard reads 14.30000.0. Change upper dials to read 44.0. Lower dials read 173.40289.03 and triangle FEI has been added.

10. Clear the keyboard. Considering the figure in the lower dials, 173.40289.03, as two separate answers, 173.40 and 289.03, add the two together. The result is 462.43, which number divided by 2 gives the fill area 231.215 square feet, figure ATBDFIHU.

1. In computing the cut area, turn 42.8 into the upper dials and set 17.0, the starting point and 21.0, the next counter clockwise point, on the keyboard. Keyboard reads 21.00017.0. Change upper dials to 41.5. Lower dials read 99972.69977.90 and the trapezoid GJKH has been subtracted.

2. Set 41.0 on the right of the keyboard. Keyboard reads 21.00041.0. Change upper dials to 39.5. Lower dials read 99930.69895.90 and the trapezoid JMLK has been subtracted.

3. Set 45.0 on the left of the keyboard. Keyboard reads 45.00041.0. 45.0 is the same elevation (39.5) as 41.0 so the upper dials do not change and lower dials remain 99930.69895.90.

4. Set 50.0 on the right of the keyboard. Keyboard reads 45.00050.0. Change upper dials to 44.5. Lower dials read 155.70145.90 and the trapezoid PMNO has been added.

5. Set 30.0 on the left of the keyboard. Keyboard reads 30.00050.0. Change upper dials to 45.0. Lower dials read 170.70170.90 and the trapezoid RPOQ has been added.

6. Set 17.0 on the right of the keyboard. Keyboard reads 30.00017.0. Change upper dials to 42.8. Lower dials read 104.70133.50 and the trapezoid RGHQ has been subtracted.

7. Clear the keyboard. Set 104.70 on the right side of the keyboard rows 5 to 1. Keyboard reads 000104.70. Add once with the carriage in the first position and subtract once with the carriage in the sixth position. Lower dials read (dials 5 to 1) 238.20. Divide mentally by 2 and the answer is 119.10, the cut area figure HKLNOQ.

GENERAL NOTES

There are several contingencies which should be considered when using the machine method, depending upon the type of machine, the number of rows on the keyboard, the farthest distance used, and the size of the areas. These contingencies may cause errors and so will be considered.

1. There are so many different types and makes of calculators being used that no attempt will be made to follow every step on each machine, but it is suggested that an operator, when following the examples, note the unnecessary numbers which appear to the left on the lower dial (step #3 computing the fill area and step #4 computing the cut area) so that error will not be made by incorporating such numbers in the final answers.

2. When using an eight row keyboard with distances not exceeding 99.9 feet, error may be made (if the final area is 500.00 or more square feet) by the area on the right of the lower dials running into the area on the left when the area on the right becomes too large. However an error of this kind will be at least 500.00 square feet in the final area and by observation can be seen when it appears on the machine. When using a ten row keyboard, the same thing may happen if the final area is more than 5000.00 square feet.

3. When the area is too large to work on your machine, split the area into enough parts so that it may be worked.

4. If the area extends past 100.0 feet, out from center-line, and there is therefore not enough rows on the keyboard (applicable to an eight row keyboard), subtract some constant from the distance on each rod reading and proceed as usual.

5. If on some area there is doubt, check it by longhand and the operator will soon become familiar with any machine errors.

6. If it is desired to figure exceedingly large areas (applicable particularly to overhaul) two machines may be used at the same time.

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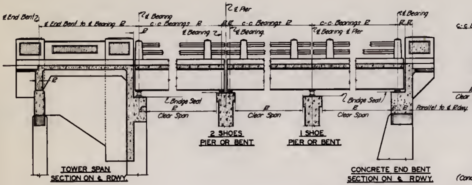
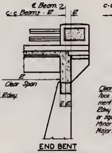


TOWER SPAN
SECTION ON ℄ RDWY.

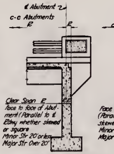
2 SHOES
PIER OR BENT

1 SHOE
PIER OR BENT

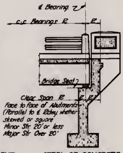
CONCRETE END BENT
SECTION ON ℄ RDWY.



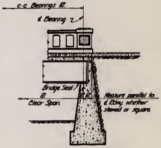
END BENT
SECTION ON ℄ RDWY.
(Conc T Beams Monolithic with Bent.)



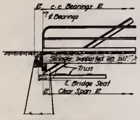
CONCRETE ABUTMENT
SECTION ON ℄ RDWY.
Conc T Beam Monolithic with Abut.
(Similar for Concrete Slab)



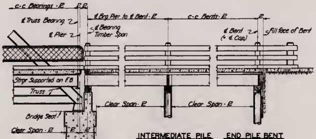
STEEL OR CONCRETE
GIRDER ON SHOE



GRAVITY ABUTMENT
WITH GIRDER SHOE



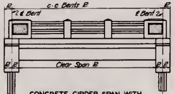
(OBSOLETE) TRUSS ON GRAVITY
ABUTMENT



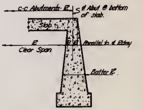
CONCRETE PIER

INTERMEDIATE PILE
BENT (SINGLE ROW)

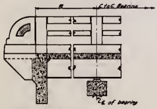
END PILE BENT
(SINGLE ROW)



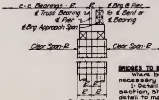
CONCRETE GIRDER SPAN WITH
CONCRETE PILES



SLAB MONOLITHIC WITH
GRAVITY ABUTMENT



CANTILEVER SPAN
SECTION ON ℄ RDWY.



PILE PIER

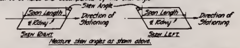
BRIDGES TO BE USED IN PLACE:—

Where bridges are to be used in place, it will be necessary to furnish the following data:

1· Detail drawing of structure, including cross section, showing all members in sufficient detail to make a complete H Rating analysis of the structure.
2· Stationing of ends of deck.
3· Stationing of centerline of bearing of all spans.
4· Centerline profile of groundline under structure.
5· Elevation of normal water and of highwater.
6· Roadway width between curbs.
7· Roadway width between rails
8· Overall width—out to out of rail posts

NOTES

All measurements shown on longitudinal sections marked "R" shall be made in the field and shall be measured parallel to roadway, or if measured normal to piers and bents shall be so noted and accompanied by the skew angle



Measure skew angles as shown above.

Measurements normal to ℄ Roadway shall consist of the following, Width of Roadway, at top of curbs (and at bottom), Center to center of rails, Out to out of curbs, Center to center of bearings.

Elevations shall be noted at the following points at each bent or pier, Roadway surface at ℄ of Roadway, Underside of superstructure, Bridge seat, Center of bearing pins, if used, and High Water elevation, Profile of stream and other topography required

Measurements shall be accompanied by sketches in notebook indicating clearly the part measured and the direction, (skew).

In addition to measurements and sketches noted above, the following information shall be submitted—

BRIDGE OVER ____ ,PROJ. NO. __ ,FED. AID ROUTE NO. __________.
BRIDGE DESCRIPTION___,STATION____,COUNTY______,ERECTED (DATE),
FABRICATED BY_____,BUILT BY_______

STATE MONTANA
STATE HIGHWAY COMMISSION

TIES FOR BRIDGE ENDS, PIERS
AND BENTS

APPROVED SEPT. 1, 1933
PRECONSTRUCTION ENGINEER

Revised ~ T.H.J. ~ 11-25-49
" I.W.H. 5-4-53

DRAWING NO. Z-79

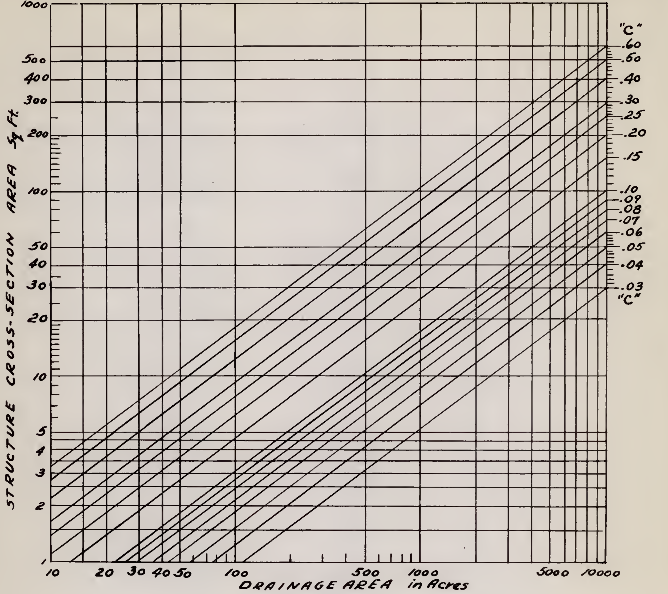
212
BR

AREA OF CIRCULAR & PIPE ARCHES

CIRCULAR PIPE SIZE	PIPE-ARCH SIZE	CROSS-SECT. AREA SQ. FT.	SECTIONAL CIRCULAR PIPE SIZE	MULTI-PLATE PIFE-ARCH SIZE	CROSS-SECT. AREA SQ. FT.
	18" X 11"	1.1	60"		19.6
	22"X13"	1.6	66"		23.8
18"		1.8		6'5"X4'9"	23.8
	29"X18"	2.8	72"		28.3
24"		3.1	78"		33.2
	36"X22"	4.4		7'9"X5'4"	33.3
30"		4.9	84"		38.5
	43"X27"	6.4		8'11"X6'0"	42.7
36"		7.1	90"		44.2
	50"X31"	8.7	96"		50.3
42"		9.6		10'3"X6'5"	54.5
	58"X36"	11.4	102"		56.7
48"		12.6	108"		63.6
	65"X40"	14.3		11'10"X7'6"	70.0
54"		15.9	114"		70.9
	72"X44"	17.6	120"		78.5
60"		19.6		13'3"X8'0"	84.8
72"		28.3	126"		86.6
84"		38.5	132"		95.0
				14'2"X8'8"	95.9
			138"		103.9
			144"		113.1
				15'9"X9'7"	114.3
			150"		122.7
			156"		132.7
			162"		143.1
			168"		153.9
			174"		165.1
			180"		176.7

APPROVED - JAN. 1, 53
CONTROL ENGINEER

RUN-OFF FOR CULVERT DESIGN - TALBOT'S FORMULA



TALBOT'S FORMULA

$$A = CM^{\frac{3}{4}} = C\sqrt[4]{M^3}$$

A = AREA OF CULVERT OPENING IN SQ. FT.
M = AREA DRAINED IN ACRES.
C = CONSTANT

EXAMPLE

DRAINAGE AREA ABOVE A GIVEN POINT ON A STREAM NEAR KALISPELL, MONTANA IS 100 ACRES. IT IS ESTIMATED THAT 1/4 OF THE AREA IS ROUGH & HILLY & 3/4 IS ROLLING FROM MAP STD#223-TF. THE RAINFALL INTENSITY NEAR KALISPELL IS 1.00" PER HOUR.

ROUGH, HILLY TOPOGRAPHY $C = 0.167$ } (SEE STD. #223-TF)
ROLLING TOPOGRAPHY $C = 0.083$ }

THEN

$C = 1/4(0.167) + 3/4(0.083) = 0.104$
$A = .104(100)^{.75}$

FROM CHART ABOVE
A = 3.29 SQ. FT. USE A 30" PIPE
(SEE STD#221-C3)

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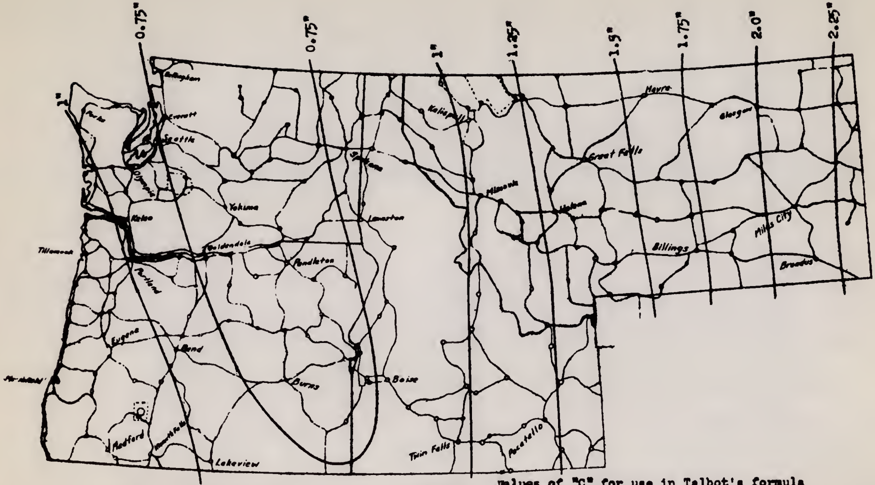
MONTANA STATE HIGHWAY COMMISSION

REV. 10-1-51

Montana State Highway Commission.

6-6-45



Federal Works Agency
Public Roads Administration

TALBOT'S "C" MODIFIED FOR VARIATION IN RAINFALL

Map shows principal highways and one hour rainfall to be expected once in 25 years in Washington, Oregon, Idaho and Montana.

Values of "C" for use in Talbot's formula

Rainfall Intensity Inches/Hour	TOPOGRAPHY					
	Mountainous	Rough Hilly	Hilly	Rolling	Gently Rolling	Flat
0.75	0.188	0.125	0.094	0.062	0.047	0.038
1.00	0.25	0.167	0.125	0.083	0.062	0.05
1.25	0.312	0.208	0.156	0.104	0.078	0.062
1.50	0.375	0.25	0.188	0.125	0.094	0.075
1.75	0.438	0.292	0.219	0.146	0.109	0.088
2.00	0.5	0.333	0.25	0.167	0.125	0.1
2.25	0.562	0.375	0.281	0.188	0.141	0.112

APPROVED - JAN. 1, 53
CONTROL ENGINEER

223
TF
EX. 433.1

TABLES FOR WIDENING & SUPERELEVATION

SUPERELEVATION			
DEGREE OF CURVE	WIDTH of ROADWAY		
	24′	26′	30′
1°	0.4′	0.5′	0.6′
1° 30′	0.7′	0.7′	0.8′
2°	0.9′	1.0′	1.1′
2° 30′	1.1′	1.2′	1.4′
3°	1.3′	1.5′	1.7′
3° 30′	1.6′	1.7′	2.0′
4°	1.8′	1.9′	2.2′
4° 30′ AND OVER	2.0′	2.2′	2.5′

This Table is based on the Formula $E = 0.067 \frac{V^2}{R}$

E = Rate of superelevation in feet per foot of width
V = Speed of vehicles in miles per hour (40 MPH)
R = Radius of Curve in feet.

NOTES

Superelevation shall be rotated about Profile Grade elevations, less normal crown, carried on the inside of the curve one-half the width of finished roadway from centerline, and shall begin on the tangent 100 feet from the the end of the curve, increasing uniformly only the elevation of the outside shoulder until the outside half of the roadway is on a plane with the crown of the inside half; then uniformly increasing the superelevation the whole width of the roadway on a flat plane until full elevation is reached at the P.C. Carry full superelevation on a flat plane from P.C. to P.T. and from P.T. to 100 feet beyond on tangent decrease uniformly the reverse of the increase up to the P.C.

Maximum Superelevation is one inch per foot of width. When the distance from the P.T. to the next P.C. is less than 200 feet and the curves are in the same direction, Superelevation shall be uniform between them in proportion to the superelevation of each; when the curves are in opposite directions a flat section shall be used at the mid-point and superelevation proportioned to P.C. and P.T.

Where property is closely built up in municipalities, and elsewhere, and at intersections and where other special speed restrictions exist, the rate of superelevation is to be modified to conform to reasonable speed requirements.

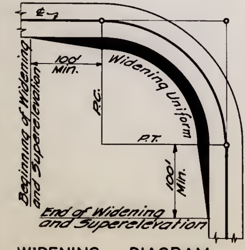
WIDENING

DEGREE	3°	4°	5°	6°	7°	8°	9°	10°	11°	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	24°	25°	26° & UP
WIDENING	2′	2′	2′	2′	2′	2′	2′	2′	3′	3′	3′	3′	3′	3′	3′	3′	3′	4′	4′	4′	4′	4′	4′	5′

THIS TABLE IS BASED ON THE FORMULA- $W = 2\left(R - \sqrt{R^2 - L^2}\right) + \frac{V}{\sqrt{R}}$

W = TOTAL WIDENING IN FEET
R = RADIUS OF THE CURVE IN FEET
L = WHEELBASE OF VEHICLE IN FEET = (20 FEET)
V = SPEED

Where the distance from the P.T. to the next P.C. is less than 200 ft. and the curves are in the same direction, the widening shall be continuous between them. If the curves are in opposite directions widen for each as per diagram.


℄
Beginning of Widening and Superelevation
100′ Min.
Widening Uniform
P.C.
P.T.
100′ Min.
End of Widening and Superelevation

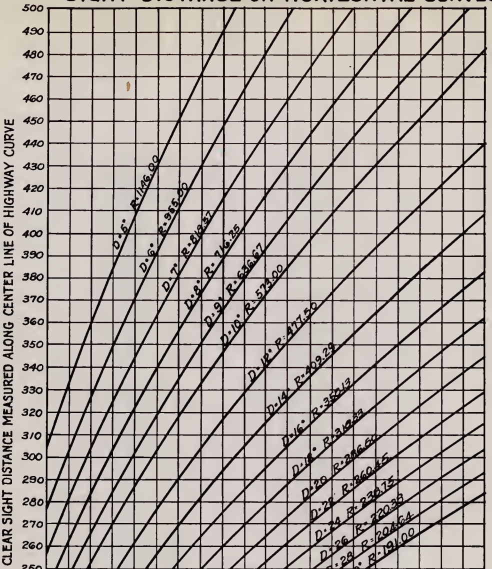
WIDENING DIAGRAM

Formula for Superelevation
Elevation $= 0.067 \times \frac{\text{Velocity}^2}{\text{Radius}}$

Formula for Widening
$W = 2\left(R - \sqrt{R^2 - L^2}\right) + \frac{V}{\sqrt{R}}$
R = Radius
L = Wheelbase = 20 feet
V = Velocity = 40 MPH

APPROVED - JAN. 1, 53
CONTROL ENGINEER

SIGHT DISTANCE ON HORIZONTAL CURVES.

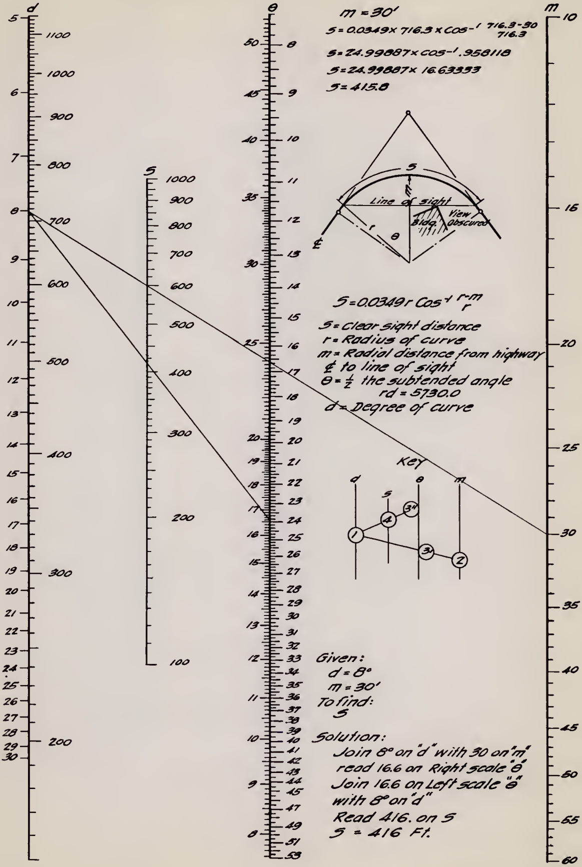


APPROVED - JAN. 1, 53
H. C. Holland
CONTROL ENGINEER

Montana State Highway Commission.

REV. 10-1-51

SIGHT DISTANCE ON HORIZONTAL CURVES



$m = 30'$

$S = 0.0349 \times 716.3 \times \cos^{-1} \frac{716.3-30}{716.3}$

$S = 24.99887 \times \cos^{-1} .958118$

$S = 24.99887 \times 16.63333$

$S = 415.8$

$$S = 0.0349 r \cos^{-1} \frac{r-m}{r}$$

S = Clear sight distance
r = Radius of curve
m = Radial distance from highway ℄ to line of sight
θ = ½ the subtended angle
rd = 5730.0
d = Degree of curve

Given:
d = 8°
m = 30'
To find:
S

Solution:
Join 8° on "d" with 30 on "m"
read 16.6 on Right scale "θ"
Join 16.6 on Left scale "θ"
with 8° on "d"
Read 416. on S
S = 416 Ft.

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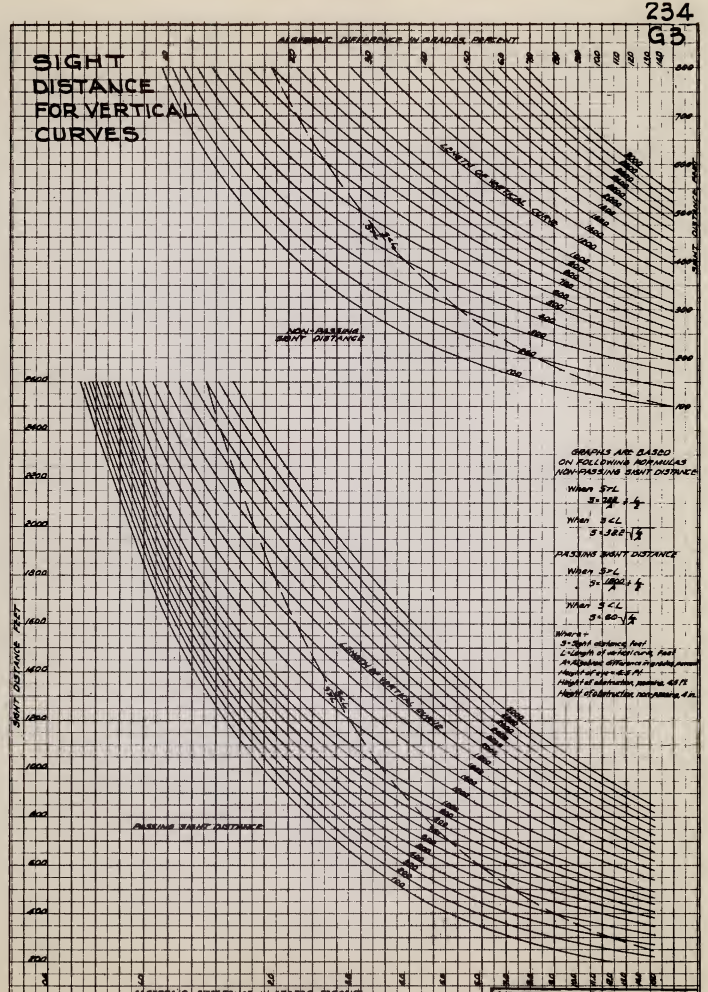
REV. 10-1-51

SIGHT DISTANCE FOR VERTICAL CURVES.



GRAPHS ARE BASED
ON FOLLOWING FORMULAS
NON-PASSING SIGHT DISTANCE

When S>L

$$S = \frac{788}{A} + \frac{L}{2}$$

When S<L

$$S = 38.2\sqrt{\frac{L}{A}}$$

PASSING SIGHT DISTANCE

When S>L

$$S = \frac{1800}{A} + \frac{L}{2}$$

When S<L

$$S = 60\sqrt{\frac{L}{A}}$$

Where:-
S = Sight distance, feet
L = Length of vertical curve, feet
A = Algebraic difference in grades, percent
Height of eye = 4.5 Ft.
Height of obstruction, passing, 4.5 Ft.
Height of obstruction, non-passing, 4 in.

APPROVED - JAN. 1, 53
V. C. Helland
CONTROL ENGINEER

TABLE FOR COMPUTING YARDAGE

L=LENGTH K=CONSTANT S=SUM OF AREAS
FORMULA, SXK OPPOSITE L=CU. YDS.

L	K	L	K	L	K	L	K	L	K
1	.01852	21	.38889	41	.75926	61	1.12963	81	1.50000
2	.03704	22	.40741	42	.77778	62	1.14815	82	1.51852
3	.05556	23	.42593	43	.79630	63	1.16667	83	1.53704
4	.07407	24	.44444	44	.81481	64	1.18519	84	1.55556
5	.09259	25	.46296	45	.83333	65	1.20370	85	1.57407
6	.11111	26	.48148	46	.85185	66	1.22222	86	1.59259
7	.12963	27	.50000	47	.87037	67	1.24074	87	1.61111
8	.14815	28	.51852	48	.88889	68	1.25926	88	1.62963
9	.16667	29	.53704	49	.90741	69	1.27778	89	1.64815
10	.18519	30	.55556	50	.92593	70	1.29630	90	1.66667
11	.20370	31	.57407	51	.94444	71	1.31481	91	1.68519
12	.22222	32	.59259	52	.96296	72	1.33333	92	1.70370
13	.24074	33	.61111	53	.98148	73	1.35185	93	1.72222
14	.25926	34	.62963	54	1.00000	74	1.37037	94	1.74074
15	.27778	35	.64815	55	1.01852	75	1.38889	95	1.75926
16	.29630	36	.66667	56	1.03704	76	1.40741	96	1.77778
17	.31481	37	.68519	57	1.05556	77	1.42593	97	1.79630
18	.33333	38	.70370	58	1.07407	78	1.44444	98	1.81481
19	.35185	39	.72222	59	1.09259	79	1.46296	99	1.83333
20	.37037	40	.74074	60	1.11111	80	1.48148	100	1.85185

MONTANA STATE HIGHWAY COMMISSION

REV. 10-1-51

REVISED-MARCH 26, 1946

APPROVED - JAN. 1, 53
CONTROL ENGINEER

SHRINKAGE FACTORS
FOR ESTIMATING GRADING QUANTITIES
PER STATION UNCLASSIFIED
DOUBLE END AREA

%	DOUBLE END AREA
135	0 ——— 54
125	55 ——— 162
120	163 ——— 378
115	379 ——— 540
110	541 →

FOR SWELL ON ROCK – SEE PLANS

Montana State Highway Commission

APPROVED - JAN. 1, 53
CONTROL ENGINEER

REV. 1-29-52

242
SF

SHRINKAGE FACTORS FOR ESTIMATING GRADING QUANTITIES

PER STATION

UNCLASSIFIED

FOR SWELL ON ROCK - SEE PLANS

CU. YDS.	TO	CU. YDS.	%
1		100	35 %
101		300	25 %
301		700	20 %
701		1000	15 %
1001 UP			10 %

Montana State Highway Commission.

APPROVED - JAN. 1, 53

CONTROL ENGINEER

REV. 10-1-51

243
SF

LUMBER TABLE

244
L

NOTE :- + or - means + or - ⅓ B.F. (For instance^{+}) exact 853.33

SIZE	LENGTH																	
	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
2 x 4	4	5+	7-	8	9+	11-	12	13+	15-	16	17+	19-	20	21+	23-	24	25+	27-
2 x 6	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
2 x 8	8	11-	13+	16	19-	21+	24	27-	29+	32	35-	37+	40	43-	45+	48	51-	53+
2 x 10	10	13+	17-	20	23+	27-	30	33+	37-	40	43+	47-	50	53+	57-	60	63+	67
2 x 12	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80
3 x 4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
3 x 6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60
3 x 8	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	78
3 x 10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
3 x 12	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120
4 x 4	8	11-	13+	16	19-	21+	24	27-	29+	32	35-	37+	40	43-	45+	48	51-	53+
4 x 6	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80
4 x 8	16	21+	27-	32	37+	43-	48	53+	59-	64	69+	75-	80	85+	91-	96	101+	107-
4 x 10	20	27-	33+	40	47-	53+	60	67-	73+	80	87-	93+	100	107-	113+	120	127-	133+
4 x 12	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144	152	160
6 x 6	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120
6 x 8	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144	152	160
6 x 10	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200
6 x 12	36	48	60	72	84	96	108	120	132	144	156	168	180	192	204	216	228	240
* 8 x 8	32	43-	53+	64	75-	85+	96	107-	117+	128	139-	149+	160	171-	181+	192	203-	213+
8 x 10	40	53+	67-	80	93+	107-	120	133+	147-	160	173+	187-	200	213+	227-	240	253+	267-
8 x 12	48	64	80	96	112	128	144	160	176	192	208	224	240	256	272	288	304	320
8 x 16	64	85+	107-	128	149+	171-	192	213+	235-	256	277+	299-	320	341+	363-	384	405+	427-
° 10 x 10	50	67-	83+	100	117-	133+	150	167-	183+	200	217-	233+	250	268-	283+	300	317-	333+
10 x 12	60	80	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380	400
12 x 12	72	96	120	144	168	192	216	240	264	288	312	336	360	384	408	432	456	480
12 x 14	84	112	140	168	196	224	252	280	308	336	364	392	420	448	476	504	532	560
14 x 14	98	131-	163+	196	229-	261+	294	327-	359+	392	425-	457+	490	523-	555+	588	621-	653+
* 6 x 18	54	72	90	108	126	144	162	180	198	216	234	252	270	288	306	324	342	360
° 8 x 18	72	96	120	144	168	192	216	240	264	288	312	336	360	384	408	432	456	480

Montana State Highway Commission

APPROVED - JAN. 1, 53

CONTROL ENGINEER

REV 10-1-51

MONTANA STATE HIGHWAY COMMISSION

TABLE OF EQUIVALENTS OF INCHES AND FRACTIONS OF INCHES IN DECIMALS OF A FOOT

INCHES	0	1/8	1/4	3/8	1/2	5/8	3/4	7/8
0	0	.01042	.02083	.03125	.04167	.05208	.06250	.07292
1	.0833	.0938	.1042	.1146	.1250	.1354	.1458	.1563
2	.1667	.1771	.1875	.1979	.2083	.2188	.2292	.2396
3	.2500	.2604	.2708	.2813	.2917	.3021	.3125	.3229
4	.3333	.3438	.3542	.3646	.3750	.3854	.3958	.4063
5	.4167	.4271	.4375	.4479	.4583	.4688	.4792	.4896
6	.5000	.5104	.5208	.5313	.5417	.5521	.5625	.5729
7	.5833	.5938	.6042	.6146	.6250	.6354	.6458	.6563
8	.6667	.6771	.6875	.6979	.7083	.7188	.7292	.7396
9	.7500	.7604	.7708	.7813	.7917	.8021	.8125	.8229
10	.8333	.8438	.8542	.8646	.8750	.8854	.8958	.9063
11	.9167	.9271	.9375	.9479	.9583	.9688	.9792	.9896

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T.

CONCRETE REINFORCING STEEL BARS

BAR SIZES		WEIGHT POUNDS PER FOOT	NOMINAL DIMENSIONS-ROUND SECT.		
OLD (INCHES)	NEW (NUMBER)		DIAMETER INCHES	CROSS SECT. AREA-SQ.INCH.	PERIMETER INCHES
1/4	2	.167	.250	.05	.786
3/8	3	.376	.375	.11	1.178
1/2	4	.668	.500	.20	1.571
5/8	5	1.043	.625	.31	1.963
3/4	6	1.502	.750	.44	2.356
7/8	7	2.044	.875	.60	2.749
1	8	2.670	1.000	.79	3.142
1	9	3.400	1.128	1.00	3.544
1 1/8	10	4.303	1.270	1.27	3.990
1 1/4	11	5.313	1.410	1.56	4.430

The new bar numbers are based on the number of 1/8 inches included in the nominal diameter of the bar.

Bar number 2 in plain rounds only. Bars numbered 9, 10 and 11 are round bars and equivalent in weight and nominal cross-sectional area to the old type 1", 1-1/8" and 1-1/4" square bars.

The above weights were adopted as standards by the Institute in 1934 and supersede former practice.

These weights have been approved through the U.S. Department of Commerce Simplified Practice Recommendation R 26-50

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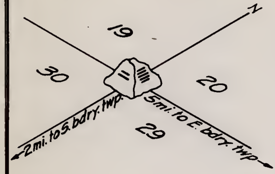
MARKS ON STONE MONUMENTS

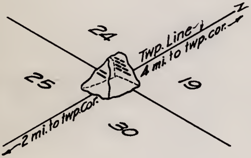
Stone corners may be notched on edges, or grooved on faces depending on how stone is set in relation to cardinal points. For convenience, illustrations below show grooves.



INTERIOR CORNER

COMMON TO FOUR SECTIONS

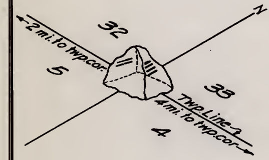
Number of grooves on East and South faces indicates number of miles from East and South boundaries of the township.



EXTERIOR CORNER

COMMON TO FOUR SECTIONS ON N.&S. TOWNSHIP LINE

Number of grooves on North and South faces indicate number of miles from corresponding township corners.



EXTERIOR CORNER

COMMON TO FOUR SECTIONS ON E.& W. TOWNSHIP LINE

Number of grooves on East and West faces indicates number of miles from corresponding township corners.

Where ties are to be made to land corners, the field party should have a copy of the U.S.G.L.O. notes pertaining to same.

The topography, description of corners and markings, bearing trees and courses contained therein are indispensable for identifying old corners.

For markings used in special cases such as closing corners, meander corners, witness corners, etc., see Manual of Instructions for Survey of Public lands issued for the U.S.G.L.O.

All locators and R/W field men should be familiar with means of identifying corners and also with legal procedure for reestablishing lost and obliterated corners.

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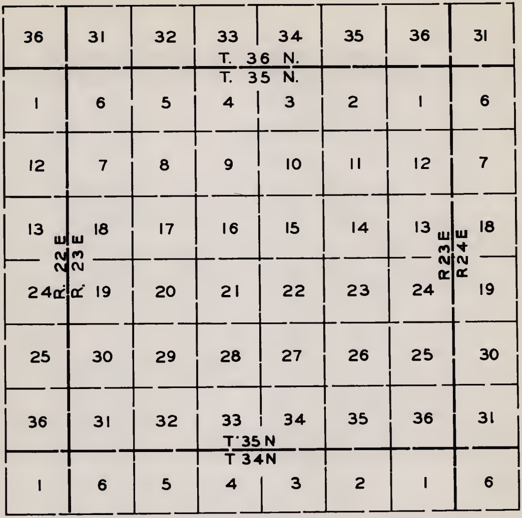
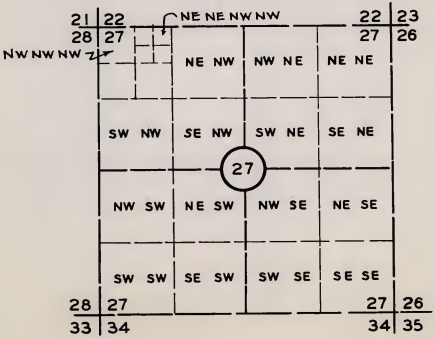
TYPICAL SECTION AND TOWNSHIP PLATS





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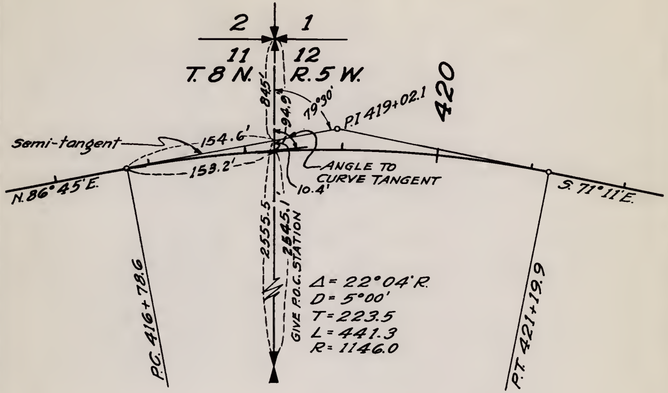
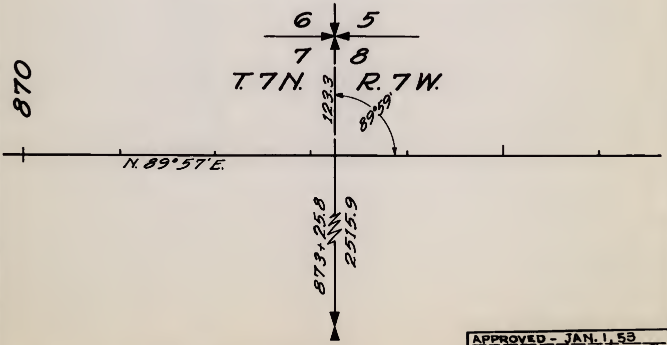
TIE TO SECTION LINE ON CURVE



Describe in detail type of corner tied to.

TIE TO SECTION LINE ON TANGENT



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WITNESS MONUMENTS FOR CORNERS

METHODS OF WITNESSING CORNERS WHICH WOULD BE DESTROYED BY HIGHWAY CONSTRUCTION

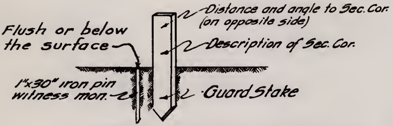
Corners to be witnessed where ever possible by 4 monuments so that original point can be located by intersecting alone. Where the lay of the land or obstructions is such as to prohibit the intersection method, not less than 2 monuments are to be used in tying the corner. The engineer will be expected to exercise his best judgment in selecting the position for witness corners with a view to affording definite and convenient connections from the witness corners to the true point for the monument.

When corner is in fill, cover corner and record as shown in example.

When corner is in cut, reset corner from witness monuments, placing same at least 12 inches below road surface and record depth in notes.

Where ever possible place witness monuments 1 ft. inside R/W lines.

Notes, accompanied by sketch, are to be filed in the office of the County Clerk and Recorder and copy of same to be sent to the office of the Cadastral Engineer in Billings and the general office of the State Highway Commission in Helena.


Distance and angle to Sec. Cor. (on opposite side)
Flush or below the surface
Description of Sec. Cor.
1"x30" iron pin witness mon.
Guard Stake

SKETCH SHOWING METHOD OF MARKING & PLACING GUARD STAKES

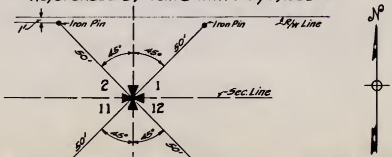
Terry, Mont.
Aug. 2, 1935

I hereby certify that the section corner of Section 1-2-11 and 12, T29N - R45E MPM is covered by highway embankment 4 ft. in depth, that the corner is referenced with iron pins 1" x 30" set at the angles and distances as shown and that guard stakes, giving description of corner, angles and distances as set adjacent to each reference monument.

Tom Smith
Project Engineer
Montana State Highway Comm.

EXAMPLE

PUBLIC ( ) SURVEY MONUMENT
Corner to Sections 1-2-11-12 T29N-R45E
Referenced by Tom Smith Aug. 2, 1935



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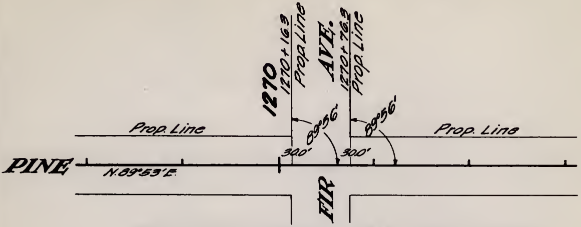
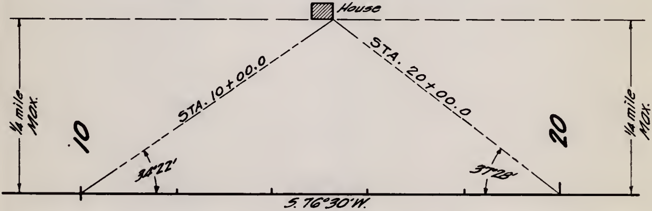
TIE TO PROPERTY LINES

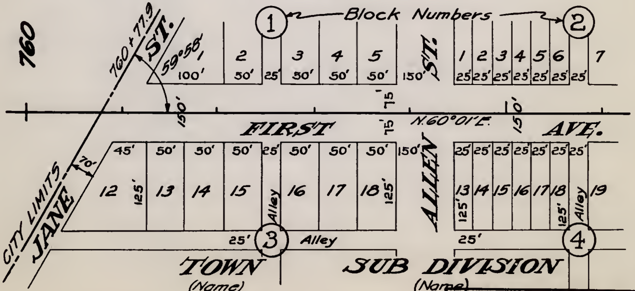


TIE FOR TOPOG. TOO FAR FROM LINE TO CHAIN CONVENIENTLY



TIE TO CITY OR TOWN LIMITS

Legal description of city or town to be submitted with location survey notes.



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CONTROL ENGINEER

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REV. 1-30-52

CONVENTIONAL SIGNS (CONTRACT PLANS)

PRIMARY ROADS .08 INCH WIDE *ALL OTHERS .05 INCH WIDE*	═════════
PRIMITIVE ROADS	═ ═ ═ ═ ═
UNIMPROVED ROADS	═════════
GRADED ROAD	□□□□□□□□□□□□
GRAVELED ROAD	■□■□■□■□■□■□
OILED ROAD	■▤■▤■▤■▤■▤■▤
PAVED ROAD (BRICK OR CONC.)	▬▬▬▬▬▬▬▬▬
FED. AID ROUTING (NON-EXISTENT ROAD)	- - - - - - - - -
FED. AID ROUTING (ON EXISTING ROAD)	═ ═ ═ ═ ═ ═ ═
HIGHWAY BRIDGE (OVER 20' CLEAR SPAN). *W = WOOD, S = STEEL, C = CONCRETE (ABOVE)* *T = TRUSS, G = GIRDER (BELOW).*	S T
DRAWBRIDGES	═══)(⊙)(═══
ARCHBRIDGES	═══⌒═══
FREE FERRIES	═══| F.F. |═══
TOLL FERRIES	═══| T.F. |═══
HIGHWAY TUNNELS	═══]- - -[═══
PASS	PIPESTONE PASS ELEV. 6348
U.S. HIGHWAYS	10
STATE HIGHWAYS	23
FED. AID SYSTEM	*F.A.*
FED. AID SECONDARY SYSTEM.	*F.A.S.*
DAM WITH ROAD	═══✱═══
DAM WITHOUT ROAD	✱
RAILROAD (LARGE SCALE MAPS).	▬▭▬▭▬▭▬
RAILROAD (SMALL SCALE MAPS).	+++++++++++++
RAILROAD STATIONS	++++++■++++++

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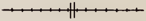
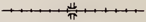
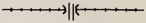
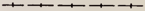
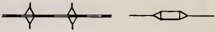
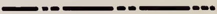
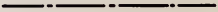
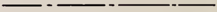
CONTROL ENGINEER

REV. 10-1-51

CONVENTIONAL SIGNS (CONTRACT PLANS)

	RAILROAD CROSSING	
	RAILROAD ABOVE	
	RAILROAD BELOW	
	PRIVATELY OWNED RAILROAD	
	CATTLE GUARDS	
FOR RAILROAD CROSSING PROTECTION	SIGNS (PLAIN)	
	SIGNS (REFLECTOR).	
	BELLS	
	LIGHTS (STATIONARY).	
	LIGHTS (FLASHING)	
	LIGHTS (STOP & GO).	
	WIG WAG	
	WATCHMAN	
	GATES (NOT CLASSIFIED)	
	GATES (MANUAL)	
	GATES (AUTOMATIC).	
	BARRIERS (MANUAL)	
	BARRIERS (AUTOMATIC).	
	APPROACH WARNING SIGNS (PLAIN)	
	APPROACH WARNING SIGNS (REFLECTOR).	
	STATE & NATIONAL LINE	
	COUNTY LINE	
	CITY, VILLAGE OR BOROUGH LINE	

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CONVENTIONAL SIGNS (CONTRACT PLANS)

Used on Hwy. Plan Sheets.

TOWNSHIP LINE

SECTION LINE (Showing Corner)

RESERVATION LINE

FENCE LINE

RAIL FENCE

GUARD RAIL

GUIDE POSTS

SNOW FENCE

UNFENCED PROPERTY

R/W LINE

R/W LINE (FENCED)

R.R. R/W (FENCED)

R.R. R/W (UNFENCED)

BASE OR SURVEY LINE

¢ OF STAKED LINE WHEN A PROJ. IS MADE

TRAVELED WAY

LEVEE

RETAINING WALL

CULVERTS IN PLACE

NEW CULVERTS (PLAN)

NEW CULVERTS (PROFILE).

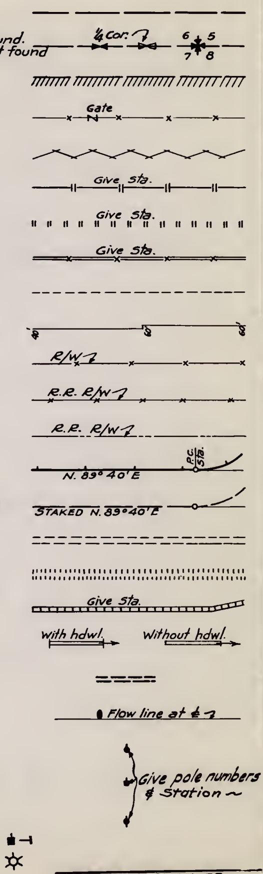
TROLLEY POLE

POWER POLE

TELEPHONE POLE

POLE, GUY WIRE & ANCHOR

LIGHT POLE



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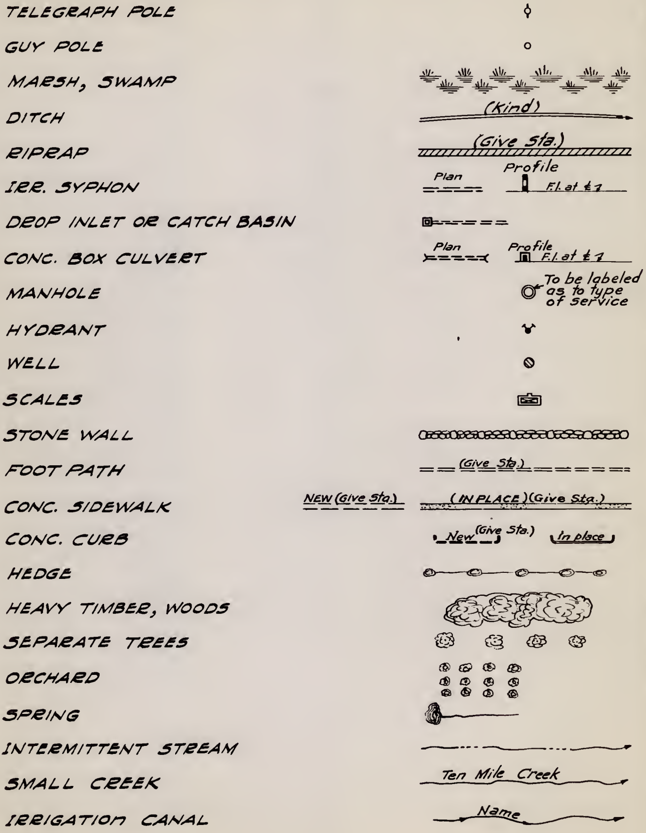
CONVENTIONAL SIGNS (CONTRACT PLANS)



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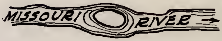
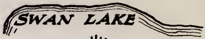
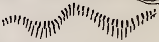
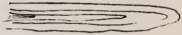
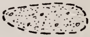
CONVENTIONAL SIGNS (CONTRACT PLANS)

RIVERS, LARGE CREEKS.	
LAKE	
BLUFFS OR CLIFFS	
GULCH	
GRAVEL PIT.	
AIR ROUTE	---Give name→---
CIVIL AERONAUTICS AUTHORITY INTERMEDIATE AIR FIELD	⌖
COMMERCIAL OR MUNICIPAL AIR FIELD	☼
MARKED AUXILIARY AIR FIELD	+
LETTER "B" INDICATES HOUSING FACILITIES	Ⓑ
GOLF GROUND OR COUNTRY CLUB	☐ C. OR G.
FAIR GROUNDS	⬭
CEMETERY	[+]
INCORPORATED TOWN	⌗
STATE CAPITAL	⊛
COUNTY SEAT	◉
OTHER TOWNS	○
FARM UNIT	■
DWELLING	◪
GROUPS OF DWELLINGS	▬
SMALL BUSINESS ESTABLISHMENT	▙
GROUP OF SMALL BUSINESS ESTABLISHMENTS	▙^{4}
TOWN HALL	☗

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D1

CONVENTIONAL SIGNS (CONTRACT PLANS)

CHURCH	⛪
SCHOOLHOUSE	🏫
CORRECTIONAL INSTITUTION	▥
INDUSTRIAL PLANT	🏭
BEET DUMP	⏶
CAMP OR LODGE	▲
RANGER OR GUARD STATION	⚑
LOOKOUT STATION	◉
SAWMILL	⌓
CAMPGROUND	▲
SEASONAL OR SUMMER COLONY DWELLING	◣
GROUP OF SEASONAL OR SUMMER COLONY DWELLING.	◣◣
MINE , QUARRY OR OPEN CUT	⚒
OIL OR GAS WELL	ஃ
TANKS	⊘
POWER PLANT	■
FORT	⌶
RADIO STATION	♜ KXLJ
GARBAGE DUMP	🄳
STATE ROAD GARAGE	⊠
GAME FARM OR FISH HATCHERY	⬙
U.S. PORTS OF ENTRY	✠
STATE COURTESY STATION	☆
STATE COURTESY STATION WITH PIT SCALES	★

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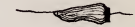
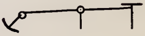
CONVENTIONAL SIGNS (CONTRACT PLANS)

CAMPS	*Boy Scout.*
GAUGING OR PUMPING STATION	⊖
PROMINENT PEAK	*Granite 12,850*
GLACIER	
RESERVOIR WITH DAM	
PROJECT MARKER	⊞
STATION MARKER	⊗
R/W MONUMENT	◊
IRON PIN, IRON PIPE OR HUB & TACK.	● I.P. or H.T.
LIGHT CABLE	— — L.C. — — — — L.C. — — —
TELEPHONE OR TELEGRAPH CABLE	— — TELEPHONE - OR - TELEG. — —
WATER LINE	— — — W — — — — — W. — — —
SEWER LINE	— — S — — — — — S — — — —
NATURAL GAS LINE	— — N.G. — — — — — N.G. — — —
GASOLINE OR OIL LINE	- - GASOLINE OR OIL — —

CONVENTIONAL SIGNS FOR USE ON CROSS SECTIONS.

POWER POLE	
TELEPHONE POLE	
TELEGRAPH POLE	
GUY POLE	
ANCHOR & POLE BRACE	

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REV. 4-1-48
REV. 10-1-51